ASTM BULLETIN

Published by
AMERICAN SOCIETY for TESTING MATERIALS

This Issue Contains

ASTM Bulletin, August, 1941. Published six times a year. January, March, May, August, October, and December, by the American Society for Testing Materials. Publication Office—20th and Northampton Sts., Easton, Pa. Editorial and advertising offices at the headquarters of the Society, 260 S. Broad St., Philadelphia, Pa. Subscription $1.50 a year in United States and possessions, $1.75 in Canada, $2.00 in foreign countries. Single Copies—25 cents. Number 111. Entered as second class matter April 8, 1940, at the post office at Easton, Pa., under the act of March 3, 1879.

AUGUST—1941

No. 111

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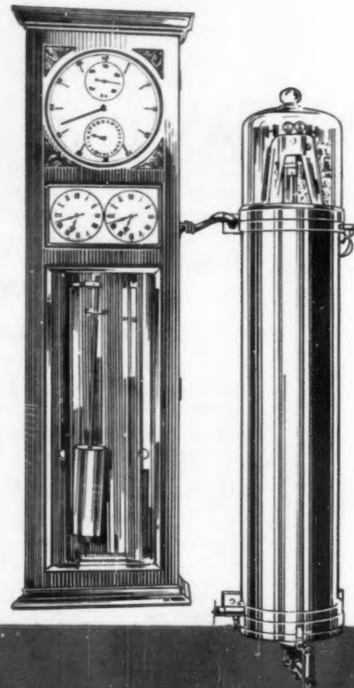

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ASTM BULLETIN

"Promotion of Knowledge of Materials of Engineering and Standardization of Specifications and Methods of Testing"

TELEPHONE—PENnypacker 3545 | R. E. Hess, Editor | CABLE ADDRESS—TESTING

R. J. Painter, Associate Editor

Number 111 | August, 1941

Record-Breaking Annual Meeting in Chicago

Largest Attendance, More Committee Meetings, Notable Committee Actions on Standards and Research

ANY MISGIVINGS which one might have had about the attendance and the success of the 1941 Annual Meeting would have rapidly dissipated on Monday morning, June 23, if they had seen the long but rapidly moving queue of members, committee members, and visitors waiting to register at the A.S.T.M. desk on the fourth floor of The Palmer House.

With national and international conditions what they are no one could accurately foretell just how many members might have to forego attending the meeting this year regardless of how important matters coming up might be to them or their connections. Therefore it is distinctly interesting to record that the total attendance of 1553 broke all previous highs, exceeding even the 1937 meeting in New York by 30. There were more members, more committee members, and more visitors registered, the respective figures being 969, 193, and 391. These figures do not include ladies of whom there were upwards of 100 officially registered, nor does it include exhibitors' representatives or the several thousand visitors who attended the Sixth Exhibit of Testing Apparatus and Related Equipment, which was in progress throughout the week of June 23.

Doctor Lundell, the new President, in his message to the members (published on another page in this issue) correctly states that there is something out of the ordinary in a Society that can attract such a high percentage of its membership to the meeting, many from distant points or from pressing duties, particularly when the meeting is devoted almost entirely to serious affairs.

The apparatus and instrument exhibit together with the Fourth Photographic Exhibition and Competition was one of the best yet held. Many of the exhibitors arranged attractive booths and there was a wide range of equipment on display, including many new items, indicating that the apparatus industry is definitely striving to provide the testing and research engineer with the necessary tools to carry out effectively his various investigations. There are separate statements on the apparatus and photographic exhibits elsewhere in this BULLETIN.

HIGH SPOTS

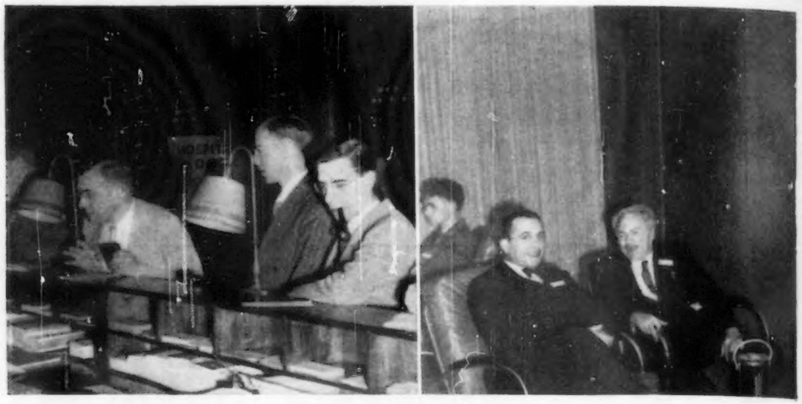
Trying to select the high spots of an A.S.T.M. annual meeting is similar to selecting the best flavored ice cream when there are 40 people and 40 different flavors. Obviously, the non-ferrous metallurgist is most interested with papers in his field and is not so much concerned with specifications for concrete aggregates (although he may very well be since there is hardly any field of materials which is not tied in pretty directly with at least half a dozen others). Certainly the opening session with the addresses of the President, Dr. William M. Barr, and J. H. Van Deventer, the introduction of the new officers, and the award of the Forty-year Membership Certificate was of interest to everyone. Practically all of the technical sessions were very well attended.

There was an exceptionally large audience awaiting Doctor Fisher's Marburg Lecture on Wednesday afternoon and several hundred attended the Thursday afternoon session at which R. Bowling Barnes, Director, Physics Division, American Cyanamid Co., described the theory, construction, and practical uses of the electron microscope.

PRESIDENTIAL ADDRESS

In his Presidential Address, the retiring President, Dr. William M. Barr, Chief Chemical and Metallurgical Engineer, Union Pacific Railroad Co., who for a great many years has been concerned with the quality, inspection, and analysis of materials, described briefly some of the important changes in concepts of the needed strength of various products going into railway equipment and track. He pointed out that all of the many improvements in material that have been evolved by research activities have required constant revision of specifications and the writing of many new specifications. This has demanded cooperative work between producer and consumer representatives and in our Society the technical committees have devoted much time to the study and discussion of this specification work. Associated with all these researches are the names of many prominent members of this Society. In closing he said, "In the existing national emergency and in the years ahead, the safety of this nation and the future success of our whole economic life will be determined by the work of the research scientist and the production engineer. As they have served so invaluably in the past four decades, so now and in the years to come, the specifications and the research work of the American Society for Testing Materials will have a

New President, G. E. F. Lundell.



Left—At the A.S.T.M. Registration Desk; Right—Newell Hamilton, Babcock & Wilcox Tube Co., and A. V. de Forest, Massachusetts Institute of Technology.

prominent place in solving the many grave problems that must be successfully solved if this nation and the American way of life are to survive!

"The services of this Society have been offered to our Government and we are proud that such services have already been accepted and are being used to advantage. Whatever may be the political or economic beliefs of any individual member, I can say with assurance that the A.S.T.M. membership will not be found wanting and will put forth every possible effort to speed all production in the interest of national safety."

Mobilizing Materials for Defense

In his paper discussing the "Mobilizing of Materials for Defense" (published elsewhere in this Bulletin), J. H. Van Deventer, President and Editor, *The Iron Age*, stressed the fact that the qualitative control of materials from the standpoint of industrial progress is even more important than their discovery and application. He mentioned the advanced state of industrial civilization we have enjoyed for about 70 years, comparing this with the 7000 years of recorded history, then said that we should definitely keep in mind that there is still much more that we do not know than we do, and we must keep this in mind in facing the tremendous task of preparing for defense or for war.

He expressed his belief that this war will probably be won by something new—probably something new in the management of materials that will enable us to bring to bear more effectively in production the overwhelming superiority that we possess in natural resources. He then reviewed the various metals and other products, probable supplies and needs, and concluded that this war is essentially a competition between nations in the production and utilization of materials. "I think that America is fortunate indeed to possess the asset of mind-power represented by your distinguished Society," he said. "As the result of your constant cooperative studies and your research we have put America at the forefront of the world's peacetime industrial procession. And now, in these critical times, you are gathered here to put and keep us in the same outstanding position for defense."

Marburg Lecture on Natural and Synthetic Rubbers

The Sixteenth Edgar Marburg Lecture, this lecture being a leading feature of the annual meeting each year commemorating the name of the Society's first secretary-treasurer, who placed its work on a firm foundation and through his development of technical programs brought wide recognition to A.S.T.M. as a forum for the discussion of properties and tests of engineering materials, was presented very ably by Dr. H. L. Fisher, Director of

Left—Alfred Sonntag, Riehle Testing Machine Div., American Machine and Metals, and Vincent E. Lysaght, Wilson Mechanical Instrument Co.; Right—Dr. W. M. Barr, Retiring President, and the new President, Dr. Lundell, in the receiving line at the Cocktail Reception.

New Vice-President, Dean Harvey.

Organic Research, U. S. Industrial Chemicals, Inc., on the subject, "Natural and Synthetic Rubbers." Doctor Fisher presented his lecture in abstract, commenting informally in his opening remarks that he quaked a bit when he realized that the man who gave him his first job in the rubber industry was in the audience.

While Doctor Fisher's lecture will appear in the *Proceedings*, printed copies of the lecture will be available in special form within the next few weeks. This item will be listed on the Members' Order Blank sent out in September, but those who wish to order copies in advance, can obtain them by writing A.S.T.M. Headquarters. A charge of 35 cents each is made to members.

He pointed out, in concluding, that vulcanized synthetic rubber compounds are superior to rubber compounds in that they show a better resistance to the action of oils and fats (vegetable and mineral) and many solvents; are more resistant to heat; age better in storage and sunlight; show a better resistance to the action of ozone and oxygen; have a lower permeability toward gases; have a lower water absorption; and show a better resistance to many corrosive chemicals, but that natural rubber still exhibits superiority to all the synthetics now available in: (1) elasticity and rebound; (2) low-heat generation through hysteresis; (3) extensibility; (4) resistance to stiffening at low temperatures.

Dudley Medal Award; Thompson Award

The fifteenth award of the Charles B. Dudley Medal was made to C. W. MacGregor, Associate Professor of Applied Mechanics, Massachusetts Institute of Technology, by President Barr. This medal commemorates the name of the first President of the Society and is awarded annually to the author or authors of a paper of outstanding merit constituting an original contribution on research in engineering materials. It was established as a means of stimulating research in materials and of recognizing meritorious contributions.

R. W. Crum, chairman of the Medal Committee, pointed out that the winning paper on the subject, The Tension Test, had in a sense put new life into our old friend, the tension test, by comparing the true values and strain and reduction of area with the many various definitions that have been proposed and used for those factors, and the author shows there is quite important information to be gained from the tension test that heretofore has not been recorded in the data.

Mr. Crum also pointed out that Dr. MacGregor, a native of Dayton, Ohio, graduated from the University of Michigan in 1929 and received bachelor's degrees in two departments, electrical engineering and engineering mathematics.

C. W. MacGregor, Dudley Medalist.

The Second Sanford E. Thompson Award, which was established by Committee C-9 on Concrete and Concrete Aggregates and which is named in honor of the first Chairman of the committee, was made to W. T. Thomson, Assistant Professor, Department of Applied Mechanics, Kansas State College. This award is an annual token of recognition to the author or authors of a paper of outstanding merit on concrete and concrete aggregates presented at an annualmeeting of the Society. Mr. Thomson's winning paper was entitled "A Method of Measuring Thermal Diffusivity and Conductivity of Stone and Concrete." Professor C. H. Scholer of Kansas State College accepted the Thompson Award, consisting of a scroll and check, for Mr. Thomson, pointing out that his inability to be present was due to his work in connection with national defense involving vibration studies in aircraft.

Standardization Accomplishments

As the nation has intensified its defense efforts and the production of important industrial war materials has increased, there has arisen a still firmer conviction of the importance of adequate specifications covering the quality and testing of materials. It has been pointed out that this country is in a far better position now than in 1917 because of the manifold increase in the number of suitable standards available. Yet there are important fields where recognized quality specifications have not been developed.

Several of the 75 new tentative standards approved at the annual meeting meet important needs—such, for instance, as the proposed new specifications for low-alloy high yield structural steels suitable for welding, the new specifications for aviation gasoline, and a number of copper and copper alloy standards developed in the work of Committee B-5. Many of the revisions made in existing standards are in line with defense requirements. Full details are incorporated in the committee reports presented at the annual meeting which were distributed to the members in advance on request.

From the accompanying table summarizing the number of actions taken at the meeting, divided according to fields covered, it will be observed there were upwards of 80 revisions of existing tentative standards; more than 80 tentative specifications and tests were recommended for adoption as standard; and a number of revisions in standards were recommended.

It will be seen that the Society will have on its books as of September 2, 1941, when the official letter ballot is closed, at least 1001 specifications, tests, and definitions—a net increase of 67 over the same period last year. (This figure will be increased in the very near future by actions taken at the August meeting of Committee E-10 on Standards at which a number of important recommendations emanating from various standing committees will be received. Full announcement will appear in the October Bulletin.)

In a separate mailing there is being sent to each member a letter ballot covering those actions involving the adoption of standards or changes in existing ones, this ballot being accompanied as customary by the Summary of Proceedings which gives detailed information on matters covered in the ballot, particularly any changes in reports made at the meeting.

A list of new tentative standards, with newly assigned serial designations, appears on another page of this Bulletin, and there is also a list of the standards which were withdrawn for various reasons, in many cases because of replacement or consolidation with other standards.

SUMMARY OF ACTIONS TAKEN AT ANNUAL MEETING AFFECTING STANDARDS AND TENTATIVE STANDARDS.

	Existing Tentative Standards Adopted as Standard	Standards in Which Revisions Will Be Adopted	New Tentative Standards	Proposed Revisions of Existing Standards Accepted as Tentative	Existing Tentative Standards Revised	Standards and Tentative Standards Withdrawn or Replaced	Present Total Standards Adopted	Present Total Tentative Standards
A. Ferrous Metals—Steel, Cast Iron, Wrought Iron, Alloys, etc.	16	11	7	12	6	3	149	35
B. Non-Ferrous Metals—Copper, Zinc, Lead, Aluminum, Alloys, etc.	2	16	20	..	32	4	49	91
C. Cement, Lime, Gypsum, Concrete, and Clay Products	17	9	11	3	4	9	114	36
D. Paints, Petroleum Products, Paper, Textiles, Rubber, Soap, etc.	51	52	37	6	35	6	327	168
E. Miscellaneous Subjects, Testing, etc.	1	..	..	..	..	..	12	20
Total	87	88	75	21	77	22	651	350

Chicago Committee; Entertainment

The activities and responsibilities of the Chicago Committee on Arrangements headed by E. R. Young, *Chairman*, Climax Molybdenum Co.; J. de N. Macomb, *Vice-Chairman*, Inland Steel Co.; C. E. Ambelang, *Secretary*, Public Service Co. of Northern Illinois; and H. H. Morgan, *Honorary Chairman*, Robert W. Hunt Co., were covered in the May ASTM Bulletin and to some extent in the final program for the meeting. The accompanying photograph of a portion of this group indicates the chairmen of the respective subcommittees. Too much credit cannot be given the Chicago group for their untiring efforts at the meeting. The following formal resolution was adopted at the closing session of the annual meeting:

Resolved, that the Society record its appreciation to the Chicago Committee for having sponsored the 1941 annual meeting and for its untiring and eminently fruitful efforts in the development and execution of plans that contributed so greatly to the success of the meeting, and that this resolution be spread upon the minutes of the meeting and that a copy be sent to the committee.

The Ladies' Committee functioned successfully under the Chairmanship of Mrs. E. R. Young, with the close assistance of Mrs. H. P. Bigler and Mrs. H. H. Morgan. There were upwards of 100 ladies present, most of whom participated in the events planned for the week, which included a tea on Monday afternoon, a special style show and tour through Marshall Fields store and a luncheon and visit to the Lasker estate on the North Shore on Thursday afternoon.

In its consideration of plans for the annual meeting, the Chicago Committee had wanted to act as host to the assembled members and selected as an appropriate means a cocktail reception which went off very successfully on Wednesday afternoon following the Marburg Lecture. With this was combined a reception to the officers of the Society, past and present, and Past-President Morgan arranged a receiving line, so that those present could be introduced to the officers. This was the first time such an event had been held at a meeting. It was met with enthusiasm by the several hundred who attended.

Golf Tournament Winners

The Twenty-fourth Annual A.S.T.M. Golf Tournament attracted upwards of 40 contestants intent on winning possession for one year of the A.S.T.M. Golf Cup (and also of having one's name engraved on this handsome trophy). The tournament was arranged by a Chicago committee headed by H. B. Emerson, Lehigh Portland Cement Co., who directed most of the advance arrangements and details, with R. F. Main, Acme Steel Co., vice-chairman of the committee in charge of the tournament during the week.

A list of the winners of the various events, and the prizes awarded, follow. These prizes were furnished through the courtesy of the Chicago Committee on Arrangements, and any members who saw the display of prizes near the A.S.T.M. registration desk at the annual meeting will agree that a most excellent selection was made.

Golf Tournament Winners and Prizes

Low Gross	E. L. Roth, Motor Castings Co.	Golf Bag and Championship Cup for one year
Second Low Gross	J. W. Ayers, C. K. Williams & Co.	Leather Traveling Case
Third Low Gross	V. A. Crosby, Climax Molybdenum Co.	Portable Radio
Daily Winners of Blind Bogey Prizes:		
Monday, June 23	A. C. Eichenlaub, Peerless Cement Corp.	Thermo Decanter Set
Tuesday, June 24	G. L. Lindsay, Universal Atlas Cement Co.	Toastmaster
	H. G. Farmer, Universal Atlas Cement Co.	Zipper Bag
Wednesday, June 25	R. E. Troutman, Krebs Pigment & Color Corp.	Remington Razor
	F. E. Bash, Driver-Harris Co.	Seth Thomas Electric Clock
Thursday, June 26	H. H. Morgan, Robert W. Hunt Co.	Desk Lamp
	J. R. Fritze, Edison General Electric Appliance Co.	Golf Bag
Friday, June 27	C. W. Lowry, Universal Oil Products Co.	Putter

Thus, Mr Roth obtains possession of the A.S.T.M. trophy cup for one year. The cup, which was put up for competition by the Climax Molybdenum Co., whose vice-president, Mr. C. M. Loeb, won permanent possession of the previous cup, is awarded permanently to the low gross winner for three years.

This is the second year that the plan of having a golf tournament in progress throughout the five days of the annual meeting was in effect, and it certainly helped to increase interest in the tournament and make it much

more convenient for members to compete. Full credit should be given Messrs. Emerson and Main and their associates for the success of the 1941 tournament.

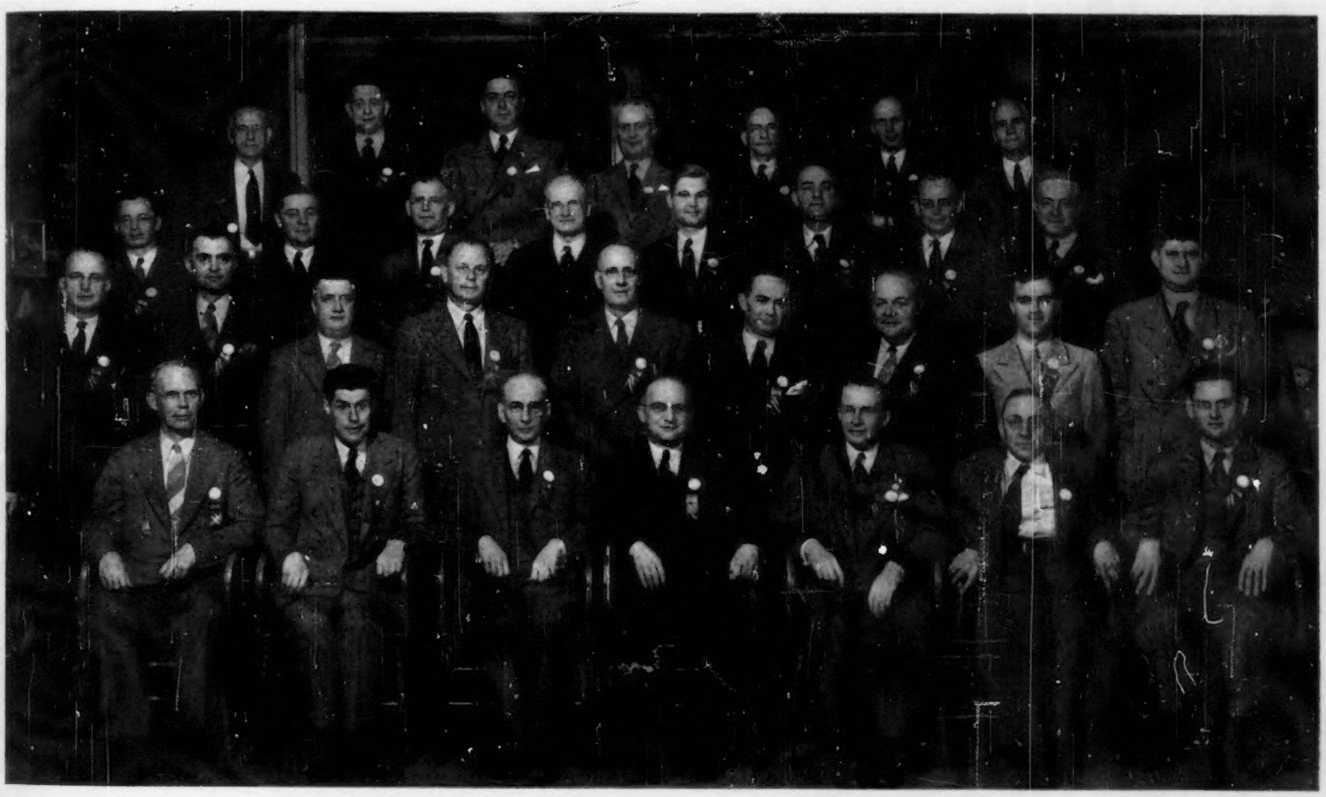
Significant Committee Reports

The report of every standing committee is important but it usually develops that certain items are of outstanding significance and that is the case this year. The report may be significant from the standpoint of standardization or research. For example, the Report of the Joint A.S.T.M.-A.S M.E. Research Committee on Effect of Temperature on the Properties of Metals was not particularly important in standardization, with only one recommendation, *but* incorporating as it does the voluminous data on the effect of low temperature on metals, to which further reference is made in another Bulletin article referring to the importance of A.S.T.M. work in relation to National Defense efforts, it is one of the outstanding 1941 reports. As a matter of fact, it ranks with the work of the same committee as represented by its 1931 symposium (primarily on high temperature) and its volume on "Creep Data" issued three years ago.

From the specific viewpoint of standardization, outstanding reports were those of A-1 on Steel, B-5 on Copper and Copper Alloys, Cast and Wrought, C-16 on Thermal Insulating Materials, D-1 on Paint, Varnish, Lacquer, and Related Products, D-2 on Petroleum Products and Lubricants, and D-13 on Textile Materials whose aggregate efforts resulted in 49 of the 75 new tentative standards. The number of new tentative standards from Committee B-5 was barely ahead of Committee D-1, the figures being 13 in the field of copper and copper alloys and 12 in the field of paint, varnish, and lacquer products.

Six of the copper and copper alloy specifications pertained to materials for sand castings, four covered leaded red brass, aluminum bronze, copper-nickel-zinc alloy, and maganese bronze rods, bars, and shapes. An important specification for copper sheet was included and two significant tests, one for the expansion of copper and copper-

(Continued on next page)



Chicago Committee on Arrangements for 1941 A.S.T.M. Annual Meeting.

First Row: W. A. Straw, Western Electric Co., *Chairman*, Committee on Information; C. E. Ambelang, Public Service Co. of Northern Illinois, *Secretary*, Chicago District Committee; J. de N. Macomb, Inland Steel Co., *Vice-Chairman*, Chicago District Committee; E. R. Young, Climax Molybdenum Co., *Chairman*, Chicago District Committee; H. H. Morgan, Robert W. Hunt Co., *Honorary Chairman*, Chicago Committee on Arrangements; A. H. Carpenter, Armour Institute of Technology, *Chairman*, Apparatus Exhibit Committee; and J. F. Calef, Automatic Electric Co., *Chairman*, Program Committee.

Second Row: H. B. Knowlton, International Harvester Co.; D. L. Colwell, Paragon Die Casting Co.; E. R. Seabloom, Crane Co.; C. C. Zeigler, Swift and Co.; A. W. Laird, Western Electric Co., *Chairman*, Photographic Committee; H. P. Bigler, Rail Steel Bar Assn., *Chairman*, Entertainment Committee; J. E. Ott, Acme Steel Co., *Chairman*, Finance Committee; G. E. Stryker, Bell & Howell Co.; and J. J. Kanter, Crane Co., *Chairman*, Publicity and Promotion Committee.

Third Row: H. P. Hagedorn, City of Chicago; C. H. Jackman, Carnegie-Illinois Steel Corp., *Chairman*, Membership Committee; C. J. Hedja, Commonwealth Edison Co.; A. O. Herz, Public Service Co. of Northern Illinois; E. R. Dillehay, The Richardson Co.; T. H. Rogers, Standard Oil Co. (Indiana); R. F. Main, Acme Steel Co.; and Paul Van Cleef, Van Cleef Brothers.

Fourth Row: Thor Nielsen, Carnegie-Illinois Steel Corp.; H. J. Schweim, Gypsum Assn.; H. C. Delzell, Concrete Reinforcing Steel Inst.; R. K. Bowden, Carnegie-Illinois Steel Corp.; L. S. Marsh, Inland Steel Co.; L. A. Blanc, A. M. Johnsen, The Pullman Co.

(A number of committee members could not be present when this picture was taken.)

Left—Getting the Committee D-1 Exhibit Booth Ready: (l. to r.) C. H. Adams and L. W. Piester, Sherwin-Williams Co.; D. D. Rubek and R. E. Johnson, Anderson-Prichard Oil Corp.; and F. C. Schmutz, New Jersey Zinc Co.; Center—The Committee on the Photographic Exhibit Comparing Notes: (l. to r.) Cromwell Bowen, Robert W. Hunt Co.; W. F. Crawford, Edward Valve and Mfg. Co.; E. R. Seabloom, Crane Co.; Thor Nielsen and M. A. Grossman, Carnegie-Illinois Steel Corp.; and A. W. Laird, *Chairman*, Western Electric Co.; Right—E. R. Seabloom and J. J. Kanter, Crane Co., and Mrs. Seabloom, at the Photographic Exhibit.

alloy tubing, called the pin test, and the mercurous nitrate test, which is an accelerated corrosion test for the purpose of determining in copper or copper-base alloy products or assemblies the presence of applied (external) or residual (internal) stresses, or a combination of these stresses, which might bring about failure of the material in service or storage through stress corrosion or season cracking.

Five of the new D-1 specifications covered pigments, four of the extender type and one, lead titanate, which has come into use. These have all resulted from consumer requests. One covers oiticica oil, one of the newer drying oils for which demand has developed. Another specification covers liquid paint dryers. Two of the three tests are extremely significant: namely, the method for preparation of steel panels for exposure tests of enamels for exterior service, and method for evaluating the degree of resistance to rusting on painted iron or steel surfaces.

The new standards submitted by Committee C-16 on Thermal Insulating Materials in its report, the first formal one submitted by the committee since it was organized in 1938, provided important test procedures covering bulk density, capacity, and volume change upon drying of cement, also sampling and preparation of specimens for testing of insulating cements. There are standardized procedures for testing thickness and density of blanket type thermal insulating materials and for compressive strength and flexural strength of preformed block type material.

The Textile Committee recommended two new specifications covering corduroy fabrics and fire-retardant properties of treated textile fabrics and also developed three new tests providing methods for evaluating compounds designed to increase resistance of fabrics and yarns to insect pests, testing asbestos tubular sleeving, and quantitative analysis of textiles. Two other tests covering commercial weight of continuous filament rayon yarns and spun rayon yarns and threads are essentially revisions of existing standards. Many other important recommendations were made by this committee which experienced one of its usual active and productive years.

While the report of Committee A-1 on Steel was not so voluminous as in other years, nevertheless seven proposed new standards, one being adopted immediately as a standard, the other six being recommended for publication as tentative, were of outstanding importance. The report included requirements which have been in much demand for low-alloy structural steel suitable for welding, these materials being characterized by relatively high yield points. Two important items were in the field of forgings, one covering carbon-steel and alloy-steel ring and disk forgings, the other covering revisions in the form of new tentative specifications for carbon-steel and alloy-steel blooms, billets, and slabs. This latter item is basic in the forging group and incorporates some 45 classes of material, 12 carbon and 33 alloy steels which are in widespread use. In preparing the new specifications, the committee had the benefit of extensive studies conducted by the American Iron and Steel Institute in their development of the so-called list of significant steels. Other new specifications cover heat-treated wrought steel wheels, hot-worked high-carbon steel tie plates (adopted immediately as standard because it is based on an existing consumer specification), and two important specifications developed in Subcommittee XIX on Sheet Steel and Steel Sheets covering light gage structural quality steel in two ranges, namely, 0.2499 and 0.1874 in. to 0.0478 in.; and 0.0477 to 0.0225 in., in thickness. A group of six tentative specifications covering various types of steel spring wire issued two years ago are being referred to letter ballot for adoption as standard.

Other reports particularly significant from the standpoint of standardization include Committee B-4 on Electrical-Heating, Electrical-Resistance, and Electric-Furnace Alloys with three important new test methods covering temper of strip and sheet metals (spring-back method), lateral wire for grids of electronic devices, and wire for supports used in electronic devices and lamps.

Committee D-2 on Petroleum Products and Lubricants offered five new tentative standards, four providing tests covering aniline point of petroleum products, carbonizable substances in paraffin wax, ignition quality of diesel fuels, and knock characteristics of aviation fuels, and, perhaps of most significance, specification requirements for aviation gasoline. The D-2 Report was a very extensive one incorporating not only these tentative standards, but numerous other recommendations, and also several proposed methods published as information only, such as neutralization number by electrometric titration, neutralization number of new and used crankcase oils, test for potential gum in aviation gasoline, and a revised diesel-fuel-oil classification.

Committees D-9 on Electrical Insulating Materials and D-11 on Rubber Products also included important items in their reports.

Research

In considering outstanding research accomplishments at the meeting each technical paper presented must of course be carefully evaluated, but a number of committee reports

(*Continued on page 12*)

White's Studios — Greystone Studios, Inc.

T. A. Fitch — C. D. Hocker — A. W. Carpenter — J. L. Miner — E. W. Upham

NEW OFFICERS

The recent election of officers, as announced at the annual meeting by the tellers, resulted in the unanimous election of G. E. F. Lundell as President (1941–1942), Dean Harvey as Vice-President (1941–1943), and the following as members of the Executive Committee (1941–1943): Arthur W. Carpenter, T. A. Fitch, Carl D. Hocker, J. L. Miner, and E. W. Upham.

President

G. E. F. Lundell, the new President, Chief, Chemistry Division, National Bureau of Standards, Washington, D. C., received his A.B. degree from Cornell University in 1903, and Ph.D. degree in 1909. He was instructor in chemistry, Northwestern University and Instructor and Assistant Professor, Cornell, 1906 to 1917. Following this, he was for nineteen years Chemist, National Bureau of Standards, Assistant Chief Chemist from 1935 to 1937, and Chief Chemist since 1937. He is in charge of the various activities of the Chemistry Division, with special interest in the analysis of ores, rocks, ceramic and metallurgical materials, and of the preparation and analysis of the Bureau's standard analyzed samples. The new President is a member of Committees A-2 on Wrought Iron, A-3 on Cast Iron, A-9 on Ferro Alloys, A-10 on Iron-Chromium, Iron-Chromium-Nickel and Related Alloys, B-2 on Non-Ferrous Metals and Alloys, and C-14 on Glass and Glass Products. He is Chairman of Committee E-3 on Chemical Analysis of Metals.

Doctor Lundell is active in the work of the American Chemical Society, being a Councilor at Large, Associate Editor of the Journal, and Chairman of the Board of Editors of the Analytical Edition of *Industrial and Engineering Chemistry.* He is a Fellow of the American Ceramic Society and a member of the Editorial Committee and of the Standards Committee, Glass Division. He is the author of numerous articles dealing with chemical analysis and co-author of three books. He was a member of the A.S.T.M. Executive Committee from 1937 to 1939 and served as Vice-President, 1939 to 1941.

Vice-President

Dean Harvey, the new Vice-President, is Materials Engineer, Engineering Laboratories and Standards Dept., Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa. A graduate of Armour Institute of Technology, Chicago, in 1900, receiving his degree of Electrical Engineer, Mr. Harvey in 1904 became connected with the Westinghouse organization as electrical engineer on detail apparatus and switchboards. Since 1911 he has been Materials Engineer, on application of materials, preparation of material specifications and test methods, and standardization of materials. He has been connected with the Society as a member and company representative since 1914.

Mr. Harvey has been especially active in the work of Committee B-4 on Electrical-Heating, Electrical-Resistance and Electric-Furnace Alloys and Committee D-9 on Electrical Insulating Materials of which he has been Chairman and Vice-Chairman, respectively, for a number of years; he is also a member of Committees A-3 on Cast Iron, D-13 on Textile Materials, and D-20 on Plastics. He served two terms on the Society's Committee E-6 on Papers and Publications, 1929 to 1935, and was Chairman of the Pittsburgh District Committee from 1934 to 1938. He was elected to the A.S.T.M. Executive Committee in 1938. Mr. Harvey is a member of the American Institute of Electrical Engineers and is affiliated with several sectional committees of the American Standards Association.

Members of Executive Committee

Arthur W. Carpenter, Manager, Testing Laboratories, The B. F. Goodrich Co., Akron, Ohio, received his B.S. degree in Chemical Engineering from the Massachusetts Institute of Technology in 1913 and the Master of Science degree in 1914. From 1914 to 1915 he was City Chemist, Alliance, Ohio, and Chemist of Akron Municipal Water Purification Plant from 1915 to 1918. From 1920 to 1921 he was with Goodyear Tire and Rubber Co.; in 1922 he was Superintendent of the Holtite Manufacturing Co., Baltimore. From 1923 to 1926 he was Development Compounder, Goodyear Tire and Rubber Co., and held the same position with the B. F. Goodrich Co. in 1927. From 1928 to date, he has been in his present position. Mr. Carpenter has been particularly active in the work of Committee D-11 on Rubber Products, having been Secretary since 1928 and a member of more than ten of its subcommittees including the Advisory Committee. He served two terms on the Society's Committee on Papers and Publications, is Vice-Chairman of the Cleveland District Committee, a member of Committee E-9 on Research and served on the A.S.T.M. Executive Committee from 1931 to 1933. He is a member of the American Institute of Chemical Engineers, American Chemical Society, and Fellow of the American Institute of Chemists.

T. A. Fitch, Director, Bureau of Standards, City of Los Angeles, Calif., is a native of Washington, D. C. Following a period as Observer in the Weather Bureau at San Francisco, Calif., and Boise, Idaho, he joined the staff of the National Bureau of Standards from 1906 to 1910. During this period he received his technical education at George Washington University. From 1911 to 1913 he was with the Standard Carbon Co. at Los Angeles, in charge of the laboratory, becoming Superintendent in 1912. Since 1914, Mr. Fitch has served the City of Los Angeles, beginning as Asphalt Tester and Chemist, in the Engineering Dept. In 1929 the present municipal Bureau of Standards which he directs, was evolved to care for the testing of engineering materials in public construction and purchase, as well as to directly serve the public in the calibration of instruments and apparatus. Mr. Fitch is a registered Civil Engineer of the State of California. His membership in the A.S.T.M. has been active and dates from 1917. He aided in forming the Southern California District Committee, on which he is now serving, and of which he was Vice-Chairman and Chairman between 1935 and 1937. He is a member of Committees C-4 on Clay Pipe and D-13 on Textile Materials.

Carl D. Hocker, Plant Products Engineer, Bell Telephone Laboratories, Inc., New York, N. Y., received his A.B. degree from Wabash

College in 1912 and his Ph.D. from the University of Michigan in 1915. In that year he entered the employ of the Western Electric Co. and in 1925 transferred to the Bell Telephone Laboratories. When the Outside Plant Development Dept. was formed in 1927, Doctor Hocker became Ceramics Apparatus Engineer. From 1934 to 1939, as Plant Materials Engineer, he was responsible for special studies of outside plant problems, timber products, and miscellaneous products. Early in 1940 he became Plant Products Engineer in charge of five groups covering wire development, outside plant tools and hardware, cable apparatus including terminals, cable joining and maintenance, timber products, and miscellaneous products. A member of the Society since 1926 he has rendered important services, particularly on Committee A-5 on Corrosion of Iron and Steel, as well as serving on other groups. He has been a member of Committee A-5 for 15 years, serving on its Advisory Committee, several of its sub-groups and is chairman of the important Section on Wire Inspection which is now responsible for the committee's country wide exposure tests on various types of wire and wire fabrics.

J. L. Miner, Director and Vice-President, Atlas Lumnite Cement Co., New York, N. Y., was born in Wilkes-Barre, Pa. He was graduated from Lafayette College in 1903 with a degree of Bachelor of Arts and then became chemist with the Alpha Portland Cement Co. and also lecturer on cement and concrete in the Civil Engineering Department of Lafayette College. He entered the employ of the Pittsburgh Testing Laboratory and became manager of the Dallas, Texas, office and, later, Manager of the New York City office. He was subsequently Chief of the Inspection Section, in the Purchase, Storage and Traffic Division of the General Staff, U. S. Army. Following his services with the Army he became manager of the Brooklyn Crozite Brick Co. Later he joined the staff of the Atlas Portland Cement Co. in a sales capacity. For a number of years Mr. Miner has been affiliated with his present company—first in connection with sales, later as technical director and vice-president. He has been a member of the Society since 1912 and has served for many years on Committee C-1 on Cement, E-8 on Nomenclature and Definitions, and was a member of Committee C-9 on Concrete and Concrete aggregates. His other Society associations include the American Concrete Institute of which he has been a member for almost 30 years.

E. W. Upham, Chief Metallurgist, Engineering Dept., Chrysler Corp., Detroit, Mich., is a graduate of the University of Michigan, class of 1913, with the degree of Bachelor of Chemical Engineering. He was first employed in the laboratories of the Maxwell Motor Co., becoming Chief Metallurgist in 1921. When the Chrysler Corp. was formed in 1923 he became a member of the Engineering Dept. of that organization, in charge of the metallurgical work—which position he has since held. Mr. Upham has been a member of Committee D-2 on Petroleum Products and Lubricants for many years and has been especially active on automotive lubrication problems of Technical Committee B. He is also a member of Committees D-13 on Textile Materials and B-5 on Copper and Copper Alloys, Cast and Wrought; on the latter committee he represents the Society of Automotive Engineers. His other society affiliations include membership in the Society of Automotive Engineers, where he has been Chairman of the Lubricants Division of the Standards Committee since 1928, a member of the Iron and Steel Division, and of the Non-Ferrous Metals Division. He is also a member of the American Society for Metals, British Iron and Steel Institute, and the Institute of Metals.

Annual Meeting Events

(*Continued from page 10*)

were notable this year from the standpoint of promoting knowledge of materials.

Reference has been made to the Report of the Joint Research Committee on Effect of Temperature on the Properties of Metals involving the use of materials at subatmospheric temperatures. This compilation of data will constitute one of the most valuable research reports emanating from this active group.

In the field of corrosion, the Report of Committee A-5 on Corrosion of Iron and Steel was marked by the extensive tabular data from the results of the first inspections after two years' exposure, in the nation-wide tests of wire and wire products, the committee drawing only tentative conclusions. Committee B-3 in its work on corrosion of non-ferrous metals and alloys submitted a statistical analysis of tensile strength results from atmospheric exposure tests of non-ferrous metals. It was felt that the statistical constants would make the available results of greater value to engineers concerned.

Committee C-5 on Fire Tests of Materials and Construction which had recommended important new methods of tests for fire-retardant properties of wood, gave in its report the results of the extensive investigations of various methods including the so-called "crib test" and "timber test" This report is an example of the extremely exhaustive investigations frequently necessary so that a committee may select an adequate testing procedure or determine proper values to incorporate in a specification The report includes a great deal of tabular and graphic information with discussion submitted by Prof. W. J. Krefeld's Subcommittee II on Fire Tests of Lumber. It covers some 40 pages.

The Research Committee on Fatigue of Metals appended to its report a detailed discussion on "The Effect of Type of Testing Machine on Fatigue Test Results." Recording the results of this extensive investigation is pertinent because of the interest of the service branches of the Government in this work and ties in with the new publication reviewed in this Bulletin entitled "Prevention of the Failure of Metals Under Repeated Stress."

Committee A-3 on Cast Iron included in its report discussion of the work of its Subcommittee VII on Microstructure of Cast Iron which led up to the new practice for evaluating the microstructure of graphite in gray iron.

Recognition of Forty-Year Member

Beginning with the 1938 annual meeting of the Society, one of the interesting features has been the recognition of forty-year members, through the presentation of a suitably engrossed certificate to those individuals or companies which have been continuously affiliated with the Society over a period of four decades.

This year at the annual meeting one "new member" to join this select group was recognized, namely, C. N. Forrest, Barber Asphalt Co. He has been extremely active in many phases of Society work, particularly in those involving bituminous and asphaltic products, road and paving and roofing materials, and the like, and he served a term as a member of the A.S.T.M. Executive Committee from 1933 to 1935.

Including Mr. Forrest, there are now 17 personal members who have received forty-year certificates, and ten companies.

Sixth Apparatus Exhibit Stresses New Developments

Several Research and Committee Displays

Two phases of the Society's Sixth Exhibit of Testing Apparatus and Related Equipment which was in progress the first four days of the annual meeting in Chicago were particularly noted by the large number of members and visitors who attended, namely, the considerable number of new pieces of equipment and various new materials available for use in testing and research; and, second, the general appearance of the exhibit which was probably one of the most pleasing of any yet held.

The first is attributable to the progressive attitude of the scientific apparatus industry which in recent years has endeavored to provide the testing engineers and scientists with up-to-date instruments. Various manufacturers of equipment have taken a more positive part in A.S.T.M. committee activities and this has been reflected in a number of improvements in the various types of so-called A.S.T.M. standard equipment.

The aesthetic aspects of the exhibit represent an integration of the individual booth displays; many of the exhibitors had unusually attractive booth decorations so that the picture as a whole was pleasing.

This latest exhibit, as have the five previous ones, stressed technical and scientific aspects of instrumentation work in the materials field. As part of this the Society has encouraged research displays sponsored by leading industrial companies in the area in which the exhibit has been held and also has arranged for special exhibits from some of the standing committees.

Outstanding this year was the booth sponsored by Committee D-1 on Paint, Varnish, Lacquer, and Related Products featuring through the cooperation of various members of the committee individual exhibits stressing important phases of the committee work. F. C. Schmutz, New Jersey Zinc Co., who with D. D. Rubek, Anderson-Prichard Oil Corp., and other D-1 people arranged the display spent considerable time throughout the week on duty explaining to quite a large number of visitors many phases of the committee's work.

Committee C-7 on Lime had an interesting display and Committee E-4 on Metallography sponsored the section of the Photographic Exhibit devoted to photomicrographs.

Several of the research displays were of interest, particularly to specific fields; for example, the display of the Dielectrics Laboratory of Commonwealth Edison Co. Testing Dept. was of definite concern to engineers interested in measuring the characteristics of types of electrical insulating materials. The Crane Co. Research Laboratories' exhibit featured a method for evaluating deposited surface coatings, through thickness measurements.

A fabric wear meter and a mattress tester, the latter possibly the most spectacular display in the exhibit, were featured by the Testing Laboratories of Montgomery Ward & Co.

The Portland Cement Association Research Laboratory and three departments of the U. S. Government, namely, the Department of Agriculture's Soil Conservation Service; the Department of the Interior, Bureau of Mines; and the Public Roads Administration, had interesting displays of their work tying in directly with the field of engineering materials.

Of particular interest to metal technologists was the large booth arranged by the Welding Research Committee of the Engineering Foundation through the cooperation of three schools: Rensselaer Polytechnic Institute, Illinois Institute of Technology, and the University of Illinois, the latter having an extensive exhibit of specimens used in the study of fatigue. Prof. W. M. Wilson who was in charge of the latter display pointed out many of the extremely interesting results in this phase of the work.

A list of the companies which took part in the commercial section of the exhibit follows:

Atlas Electric Devices Co., Inc.
Baldwin-Southwark Division, The Baldwin Locomotive Works
Christian Becker, Inc.
W. H. & L. D. Betz
Brabender Corp.
Adolph I. Buehler
Canadian Radium & Uranium Corp.
Central Scientific Co.
Colemen Electric Co., Inc.
Eastman Kodak Co.
Federal Classifier Systems, Inc.
The Gaertner Scientific Corp.
The Emil Greiner Co.
Humboldt Manufacturing Co.
Illinois Testing Labs., Inc.
Instrument Specialties Co., Inc.
Kimble Glass Co.
Lancaster Iron Works, Inc.
Leeds & Northrup Co.
Magnaflux Corp.
"Metals and Alloys"
National Carbon Co., Inc.
The Parr Instrument Co.
Precision Scientific Co.
Radium Chemical Co., Inc.
Riehle Testing Machine Division, American Machine and Metals, Inc.
E. H. Sargent & Co.
Schaar and Co.
C. J. Tagliabue Mfg. Co.
Wilkens-Anderson Co.
Wilson Mechanical Instrument Co.

Throughout the duration of the exhibit there was a good attendance with a large number of visitors. Particularly in the three evenings a great many people concerned with this field attended the exhibit. Considerable publicity had been given to it through the Society, the exhibitors, and under the auspices of the Chicago Publicity and Promotional Committee headed by J. J. Kanter. A number of local sections of engineering societies received invitation cards to attend and this work undoubtedly contributed to the large attendance. The exhibit was probably the best attended of any of those yet held.

Widespread Interest in Photographic Exhibit

Chicago Committee Arranged Interesting Display

A hard-working Chicago Photographic Committee headed by A. W. Laird, Metallurgical Engineer, Western Electric Co., arranged what in the opinion of many members was the most interesting photographic display of any yet held, but opinion on photography is of course subject to various judgments and if not the most interesting, it certainly was the equal of any the Society has sponsored. Possibly having the display in an indus-

trial center concentrated attention on the exhibition, but throughout the week there were large numbers of members, visitors, and guests viewing the various prints and photomicrographs.

Committee E-4 on Metallography had arranged a display of photomicrographs, the committee's representatives, Dr. M. A. Grossman and Thor Nielsen of Carnegie-Illinois Steel Corp., being in charge.

Following the procedure of previous years, the committee judged the prints as classified according to non-professional and professional groups. The candid camera shot reproduced on page 10 shows the committee members at work before the meeting making their choice. This year the committee attempted to solicit prints which stressed the personnel angle and many of those exhibited were in this category.

The prize winners are as follows:

NON-PROFESSIONAL

First Prize: *Measuring Deformation of a Pipe Header Under Pressure*, W. C. Wilke, Crane Co.

Second Prize: *Broken Tensile Specimens*, Mason Clogg, Jr., Rustless Iron and Steel Corp.

Third Prize: *The Rolls*, W. F. Crawford, Edward Valve and Manufacturing Co., Inc.

Honorable Mention:

Flame Spread Test of Fire-Resistive Shingles, Ben Caldwell, Underwriters' Laboratories, Inc.

Brittle Coating Strain Patterns on Head of Aircraft Engine Piston, Ferdie B. Stern and Greer Ellis, Massachusetts Institute of Technology.

The Laboratory Glass Blower, W. C. Wilke, Crane Co.

"Creep" Laboratory, E. R. Seabloom, Crane Co.

PROFESSIONAL

First Prize: *Zip! Die Cast on to Cloth—320 Elements per Minute*, R. L. Reber, The New Jersey Zinc Co. (see page 40).

Second Prize: *Night Magic*, Thor Nielsen, Carnegie-Illinois Steel Corp.

Third Prize: *X-ray of Vacuum Tube*, J. H. Waddell, Bell Telephone Laboratories, Inc.

Honorable Mention:

Taking a Test Bar from Electric Arc Furnace, W. A. Kjeldsen, Western Electric Co.

High-Speed Photography of Vocal Cords, J. H. Waddell, Bell Telephone Laboratories, Inc.

Smoke, Steel and Brawn, Thor Nielsen, Carnegie-Illinois Steel Corp.

PHOTOMICROGRAPHS

First Prize: *Widmanstätten Structure in Zinc Containing 1.5 Per Cent Copper*, J. L. Rodda and C. W. Bartholomew, The New Jersey Zinc Co.

Second Prize: *Cast Zinc Containing Lead*, J. L. Rodda and C. W. Bartholomew, The New Jersey Zinc Co.

Third Prize: *Photomicrographs of Steel Structure Using Sensitive Tint Illumination*, B. L. McCarthy, Wickwire Spencer Steel Co.

Honorable Mention:

Rolled Zinc Photographed with Polarized Light, J. L. Rodda and C. W. Bartholomew, The New Jersey Zinc Co.

Profile in Cementite, Stephen F. Urban, Carnegie-Illinois Steel Corp.

Large Viewing Box: Microstructures of Various Steels Photographed in Reflected Polarized Light Using a "Sensitive Tint" Gypsum Plate, R. C. Williams and R. I. Swanson, Carnegie-Illinois Steel Corp.

A number of the prize-winning prints will be reproduced from time to time in the ASTM BULLETIN.

Through the courtesy of L. Drew Betz of W. H. & L. D. Betz, who was a member of last year's committee, a number of special photographs of snow scenes, marine views, and landscapes were exhibited also, but not entered in the competition.

While these photographic exhibits entail considerable effort on the part of the committee in charge, particularly the chairman, they add a general interest feature to the annual meeting which is especially appreciated; they provide an opportunity for camera "bugs" in the membership and member companies to display interesting views related to the field of engineering materials, particularly testing and research; and broadly they are indicative of excellent work which can be done along illustrative lines.

"Measuring Deformation of a Pipe Header Under Pressure"

First prize-winning photograph, Nonprofessional, in the Fourth A.S.T.M. Photographic Exhibit, by W. C. Wilke, Crane Co.

A.S.T.M. National Defense Activities

Several Committee Projects Directly Related to Defense Efforts

THE SECRETARY-TREASURER in his statement on "A.S.T.M. and the National Defense Program" published in the December, 1940, ASTM BULLETIN asked the question: "How can A.S.T.M. aid?" He outlined under four broad headings how the Society could most effectively contribute to the defense program: *first*, the continued development of specifications and methods of test; *second*, continued emphasis on research in materials; *third*, the fuller utilization of the A.S.T.M. committee organization; *fourth*, aid in personnel matters.

He concluded that

> "Cooperation of A.S.T.M. in the National Defense Program can well proceed along the broad lines here described. Details must of necessity be worked out as the procurement plans of the Government and the concomitant specification activities develop. The knowledge, experience, and services of the committees, officers, and staff of the Society, and of its membership generally, are available for the fullest use in advancing the National Defense Program."

Since the publication of this statement, developments have been very rapid indeed and a broad review of the Society's activities would indicate that A.S.T.M. has contributed greatly in each of the four fields outlined. As a matter of fact, it is recognized that all A.S.T.M. work is indirectly in the interest of preparing this country for eventualities and the importance of our work and the influence of our membership in its industrial activities have been stressed time and again (by J. H. Van Deventer, for instance, in his annual meeting address, published in this BULLETIN) so that each standardization and research activity being carried on by a committee broadly ties in with the defense efforts.

However, there are certain projects instituted specifically to solve problems which have arisen in the tremendous upturn of producing war materials. Admittedly, a number of other committee projects might come under this heading, but as developments occur and these projects come to fruition, further announcements will be made in the BULLETIN.

No attempt is made to discuss these projects in order of importance. While some are along similar lines with the same broad objective, each is in a sense distinct in its specific application.

Conservation of Nickel:

Under this heading are two projects developed, respectively, by Committees B-4 on Electrical-Heating, Electrical-Resistance and Electric-Furnace Alloys and A-10 on Iron-Chromium, Iron-Chromium-Nickel and Related Alloys. At its meeting in Chicago on June 23, Committee B-4 considered an official request that it make recommendations relating to the conservation of nickel in the alloys entering its field of work. Having before it the results of studies made by the Alloys Casting Institute in collaboration with Battelle Memorial Institute, International Nickel, Electro Metallurgical Co., and with leading producers and consumers of nickel alloys contributing to the discussion, a special group was appointed by J. W. Harsch, Chairman of Subcommittee VI on Specifications, to correlate the facts and prepare recommendations to the Office of Production Management. In addition to Mr. Harsch, the group included Messrs. F. E. Bash, P. H. Brace, F. B. Foley, and R. D. Van Nordstrand.

In transmitting this report to the Secretary-Treasurer, who in turn forwarded it immediately to the Nickel Alloys Section of OPM, Dean Harvey, Chairman of Committee B-4, pointed out that in the committee's belief the benefits to be obtained from the nickel program will depend largely on the most effective use of nickel and that his committee wished to cooperate in every way possible to achieve this result.

For the information of the members, a summary of the report follows:

1. In general, nickel should be limited in heat-resisting alloys to 15 per cent, in the case of castings subjected to oxidizing conditions and controlled atmospheres at elevated temperatures.

2. Where oxidizing conditions exist and castings are not required to carry high loads, straight chromium irons containing not over 2 per cent nickel should be used in preference to alloys of the 25 per cent chromium, 12 per cent nickel type.

3. That a limit of 40 per cent nickel is adequate in heat-resisting alloys for use in carburizing and nitriding, and dry cyaniding atmospheres.

3-a. That in some gas carburizing equipment conditions are so severe as to require alloys having a high nickel content and where the necessity for using such alloys is established nickel should be limited to 62 per cent.

4. Nickel should be limited to 40 per cent for applications involving severe thermal shock.

5. The life of electric resistance heating elements is a matter of the nickel content. The types of alloys required are the 35 nickel, 15 chromium type useful at furnace temperatures up to 1400 F., 60 nickel, 12 chromium type useful at temperatures 1400 to 1650 F. and 80 nickel, 20 chromium for temperatures above 1650 F.

6. Nickel alloys in use as thermocouple material must retain present composition since these are specific to calibration.

It is understood that the OPM has in preparation an order governing the use of nickel in these types of alloys, based on these recommendations of Committee B-4.

Committee A-10 also discussed the conservation of nickel with respect to the materials in its field at its meeting in Chicago, because it had been requested to make suggestions and recommendations which might involve emergency revisions of specifications or indicate a limited number of grades and classes in present specifications which might involve lesser amounts of strategic metals, thus conserving them for defense purposes. The possibility of increasing the carbon content of alloys in order more effectively to utilize existing stock piles of scrap was discussed.

Among matters mentioned at the meeting were the possible substitution of 12–17 per cent chromium steel for 18 per cent chromium, 8 per cent nickel for tableware; the use of 20 per cent chromium, 1 per cent copper, as a substitute for the 19 chromium, 9 nickel alloy in certain nitrating operations; and several others.

The outcome of the discussion was the appointment by

Jerome Strauss, Chairman of Committee A-10, of a small committee headed by H. S. Schaufus, Chief Metallurgist, Rustless Iron and Steel Corp., which is now completing an educational statement to be published in the BULLETIN directed to consumers of stainless steels to furnish information on such problems as substitution of chromium for chromium-nickel types and the use of ordinary steels or plastics for the so-called stainless types.

Committee A-10 hopes that the statement can include reference to specifications and modifications for use during the emergency period. The committee may as a result of this intensive consideration propose temporary modifications of certain A.S.T.M. standards. It should be noted that this statement is now in preparation and as promptly as possible when approved, it will be released and publicized.

Requirements for Aluminum Ingots:

Because it is concerned with two metals which are of utmost importance particularly in aircraft and airplane engine construction, namely, aluminum and magnesium, the work of Committee B-7 on Light Metals and Alloys, Cast and Wrought, is tied in with many phases of national defense work. One recent action can be used as an example, namely, the incorporation of a new grade of 99.2 per cent aluminum for remelting purposes in the ingot specifications (B 24 – 39 T); also the modification of the zinc content in the 94.0 per cent grade for use in iron and steel (B 37 – 39 T). The addition of a fourth grade with a minimum aluminum content of 99.2 per cent to the ingot specifications B 24 will make available for quite a number of uses a grade that is not quite as pure as the highest grade material, 99.5. But this should help out materially in aluminum supply and as a matter of fact the specification is being used as a basis for the production setup of a new plant.

Another important recommendation of Committee B-7 was the addition to the Aluminum-Base Alloy Sand Castings Specifications (B 26 – 37 T), of a new aluminum-zinc-magnesium alloy, designated O. This requires about 5 per cent zinc and 0.5 per cent magnesium.

Copper and Copper Alloys:

Of all the numerous committees carrying out work directly or indirectly related to preparedness, none has exceeded in volume or importance the activities of Committee B-5 on Copper and Copper Alloys, Cast and Wrought, headed by C. H. Greenall, Bell Telephone Laboratories, Inc., New York. Reference has been made to the important standardization carried through successfully last year in cooperation with the War Department, Air Corps, and Navy Department resulting in new requirements for Cartridge Brass Case Cups (B 129 – 40 T), Gilding Metal Sheet and Strip (B 130 – 40 T) and Gilding Metal Bullet Jacket Cups (B 131 – 40 T). Extremely important changes were made in cooperation with the War Department in connection with Cartridge Brass (B 19 – 29) and Cartridge Brass Disks (B 20 – 29) resulting in one consolidated specification. Its work in these various fields has continued intensively.

This year the committee completed other important specifications some of which are referred to in the annual meeting article appearing in the front of this BULLETIN. Of these the new test method for mercurous nitrate and a test for expansion of copper and copper-alloy tubing, called the pin test, tie in directly with defense projects. The Frankford Arsenal cooperated closely in this work, which also resulted in two annual meeting papers describing the studies which were basic in the work on the mercurous nitrate test.

Another project is that sponsored by Subcommittee X on Copper-Base Alloys for Sand Castings headed by Dr. G. H. Clamer, which completed seven new tentative specifications, four of which are revisions and replacements of five existing standards which were withdrawn, two were new specifications, and one a revised tentative standard. This work is an example of simplification efforts to reduce the number of compositions to what seems to be a minimum practicable limit.

Plastics:

The Executive Committee in its 1941 report indicated that the Society must constantly be on the alert to provide standards as needed and cited as a specific instance, tests for plastics, indicating that Committee D-20 on Plastics, which is doing pioneer work in this new field, has an important responsibility in providing needed tests to evaluate suitability of the large number of these materials for a variety of new uses. Doctor Lyman J. Briggs, Director of the National Bureau of Standards, in his note on standardization published in the May ASTM BULLETIN also referred to the extreme importance of expediting work in this field. It is, therefore, pertinent to record the three new standards just published covering tests for deformation of Plastics and Electrical Insulating Materials Under Load at Elevated Temperatures, Test for Color Fastness of Plastics to Light, and Method of Preconditioning Plastics and Electrical Insulating Materials, the last item being in the joint charge of Committees D-20 and D-9. Two other tests for determining by standardized procedures tensile and impact properties are completed and are being referred to the Society this month for approval. The committee is pushing its study of adequate tests for evaluating weathering and heat resistance, permeability, and simulation of service conditions. Numerous round-robin tests are being conducted on tests for clarity, surface brightness, and a procedure for surface irregularities. Another important phase of this work is the study of bearing materials and their frictional properties.

A new subcommittee on specifications has been formed to develop quality requirements on both raw materials and finished products.

In some cases such as the work on scratch hardness and mar resistance and certain work involving permanence properties, the data so far developed are to be published in the ASTM BULLETIN so that the information will be available even though the work is not quite completed.

Properties of Metals of Low Temperatures:

While not initiated directly as a result of National Defense work, the activities of the Joint ASME-ASTM Research Committee on Effect of Temperature on the Properties of Metals involving specifically the effect of subatmospheric temperatures will prove of great value to service branches of the government, particularly the United States Army. For the past two years the committee

has had under way intensive work in this field. Following a round-table discussion at the 1939 Annual Meeting, there were distributed special forms to facilitate the compilation of data. Considerable amounts of pertinent information were received, particularly notched-bar impact test results. These were referred to H. W. Gillett at Battelle Memorial Institute who was given the assignment of preparing the final report. He classified the material and also added to it a large amount of material from the literature, principally foreign sources, supplied critical comment, and appended a comprehensive bibliography bearing on the subject. This material has been in course of editing at A.S.T.M. Headquarters in cooperation with F. B. Foley, Chairman of the Project, and it is expected to be issued shortly.

Conversion of Rockwell, Brinell and Vickers Hardness Values:

A subject considered of much importance, since it is related to the control of materials used on defense items, is an investigation of the comparative hardness values of Rockwell, Brinell, and Vickers tests. Correlation of these values is particularly important in connection with British purchasing problems and the Section on Indentation Hardness of Committe E-1 on Methods of Testing several weeks ago began an intensive study. At its Chicago meeting, the committee concluded that no single hardness conversion relation can exist for all metallic materials. Discrepancies are particularly apparent in ranges below 200 Brinell. Relations can be developed, however, for each commonly used alloy and since cartridge brass is one of the most important materials in defense, the committee is now expediting a cooperative program to fill in gaps in the required data for this material.

Materials for the Manufacture of Scientific Apparatus:

Because of the extreme importance of scientific apparatus and supplies in connection with the control, testing, and research investigations of defense materials, and the increasing difficulties on the part of instrument manufacturers in obtaining the necessary supply of certain critical materials, the subject was discussed at the meeting of Technical Committee XII on Laboratory Apparatus in Chicago, and a resolution drafted at this meeting was later formally adopted at a session of the Society. This pointed out that the amounts of critical materials involved were in small quantity and that some blanket form of priority was very desirable because with much of the apparatus made in large production units the procuring of individual priorities for each piece of equipment would involve complications and an expense beyond the cost of the equipment. The formal resolution has been transmitted for the consideration of the Priorities Division of the Office of Production Management.

Conservation of Aluminum Used in Zinc-Base Die-Casting Alloys:

Under the sponsorship of Committee B-6 on Die-Cast Metals and Alloys a series of investigations has been under way looking toward the possible reduction in aluminum content from about 4 per cent to about 1.5 to 2.0 per cent in the widely used alloys Nos. XXIII and XXV in the A.S.T.M. Specifications for Zinc-Base Alloy Die Castings (B 86 – 38 T). Before recommending any definite steps in the conservation of this strategic material, the committee felt some positive tests should be made since some questions were raised concerning possible manufacturing difficulties which may be encountered relating to hot-shortness, shrinkage, freezing range and casting characteristics of the lower aluminum alloys.

A statement of the latest developments in this work has just been received from B-6's Subcommittee II on Zinc-Base Die-Casting Alloys and is published on an adjoining page.

Miscellaneous Matters:

A number of other matters might be mentioned coming under A.S.T.M. contributions to National Defense, including the development by Committee A-1 of specifications for low-alloy structural steels, characterized by relatively high yield points involving welding grades of material. This work is of particular interest to army ordnance. The specifications for aviation gasoline, developed by Committee D-2, provide important requirements and information, and work under way in Committee B-1 on Copper and Copper-Alloy Wires for Electrical Conductors involves problems in the field of lead and lead alloy coated copper wire.

Announcement will be made from time to time of other A.S.T.M. work related directly or indirectly to National Defense problems.

Preliminary Statement on Low Aluminum Zinc-Base Die Casting Alloys

By Committee B-6 on Die Cast Metals and Alloys

The two zinc alloys most commonly used in the die casting trade today are A.S.T.M. alloys XXIII and XXV covered in Specifications B 86–38 T. Alloy XXIII is a zinc-base alloy containing 4 per cent aluminum and about 0.03 per cent magnesium. Alloy XXV differs by the inclusion of 1 per cent copper. Both alloys are compounded with special high grade (99.99 per cent) zinc, A.S.T.M. Specifications B 6–37.

The eutectic in the zinc-aluminum system occurs at about 5 per cent aluminum. Alloys containing 4 per cent aluminum are therefore close to the eutectic composition and have a short freezing range. As a result, they possess a minimum of casting difficulties, and the adoption of this aluminum content in the development of these alloys was based largely on the good casting properties coupled with what appeared to be the optimum combination of physical properties.

These standard alloys have been in commercial use for over 10 years with satisfactory service records. Now, because of the aluminum shortage, the possibility of using alloys with less than 4 per cent aluminum is being investigated. Preliminary results based on laboratory tests are now available and some conflicting commercial experience has been reported in the use of such low-aluminum alloys. At the suggestion of the OPM, this information, *whose incomplete character cannot be too strongly emphasized*, has been reviewed and is presented here, briefly, for the information of producers and consumers of zinc die

castings. There is no assurance at present that properties on which tests are not yet available may not interfere with the use of these alloys in some instances, at least, just as difficulties with casting properties have already come to light as commercial trials have followed the laboratory tests.

With respect to laboratory tests, Apex Smelting Co. has reported a considerable amount of data from which is taken the following comparison of these two alloys:

	Al, per cent	*Cu, per cent*	*Mg, per cent*
A.S.T.M. alloy XXV	4.1	1.0	0.03
Low aluminum substitute	1.5	1.0	0.03

	Alloy XXV	*Substitute Alloy*
Tensile strength, as cast, psi	44 300	40 400
Tensile strength, 10-day, 95 C water vapor, psi	34 500	28 000
Elongation, as cast, per cent	5.3	5.7
Elongation, 10-day, 95 C water vapor, per cent	3.7	5.7
Charpy impact (avg. gate and vent) as cast, ft.-lb.	38.5	34.0
Charpy impact (avg. gate and vent) 10-day, 95 C water vapor, ft.-lb.	6.7	12.8
Dimensional change on 6-in. bar, 10-day, 95 C water vapor, in.	−0.0002	−0.0006

The New Jersey Zinc Co. report that as far as their tests have gone, they have obtained substantial checks on the above results except in respect to dimensional change. Known slight differences in analysis and possible differences in casting practice will probably explain this discrepancy when a complete story is available. The New Jersey Zinc Co.'s results indicate some difference between alloy XXV and the 1.5 per cent aluminum alloy but the results are too incomplete to say whether the difference will be objectionable. They further report that to retain as favorable a comparison with the specification alloy as above, a low-aluminum substitute for alloy XXIII (4 per cent Al, 0.3 Mg) must contain at least 2.0 per cent aluminum.

Attention is drawn to the following points on which information is lacking or incomplete: (1) The range of permissible die and metal temperatures has not been determined. Some alloys of this type have been previously encountered which had a too narrow permissible range for commercial operation. (2) Creep resistance, which is a property of governing importance in many uses of zinc die castings, particularly where elevated temperatures are encountered, has not been determined. (The New Jersey Zinc Co. hope to have rapid preliminary tests available on this within a few weeks.)

Varying reports have been heard concerning the experiences of die casters attempting to use these alloys. Some difficulties have been encountered due to the difference in solidification shrinkage characteristics and greater hot shortness of the lower aluminum alloys. In some instances, these difficulties have been overcome by increasing the aluminum content from 1.5 to 2 per cent. To what extent these difficulties can be overcome by attention to die design and casting practice is not yet known. In spite of the probability that a large number of castings can be successfully made with these alloys, the available evidence indicates that due to the above difficulties some castings cannot be produced successfully with alloys of reduced aluminum content.

A.S.T.M. Publications in Defense Training Courses; New Standards Compilation for Students

IT WILL BE OF INTEREST to many in the Society to realize that the results of much of the work they may have done in developing standard specifications and test methods and in presenting papers and reports are being used in a way certainly not contemplated when a great deal of the work was nearing fruition. This use has to do with the engineering defense training courses.

When the U. S. Office of Education released information indicating the large number (upwards of 500) of courses which would be available as part of the engineering defense training program, many of the some 100 colleges giving the courses were already using A.S.T.M. publications. However, it was felt that certain of the A.S.T.M. books, in particular the compilation of "Selected A.S.T.M. Standards for Students in Engineering," might be helpful in more of these courses and a letter was addressed to the deans and engineering faculty members in charge offering to furnish to all students taking the courses any of the Society's publications at the special students' prices which are approximately half the list price to nonmembers.

Just how valuable these publications have been, no one can properly evaluate but it is significant that a great many hundred copies of A.S.T.M. books have been used, particularly in the courses involving materials inspection and testing, of which there were a very large number, proportionately.

When, and if, there is a return to any kind of a normal routine, the knowledge absorbed by the thousands of students taking defense courses involving testing and inspection should be beneficial.

The demand for "Selected A.S.T.M. Standards for Students in Engineering" which was published two years ago with a quantity estimated sufficient for over three years was so heavy that this edition was exhausted early this year and an amplified and revised edition has just been published. The special compilation not only provides the students in the engineering schools with widely used methods of tests, specifications, and definitions; it includes pertinent information about the Society, its officers, Honorary Members, and a compact history of A.S.T.M. and its purposes and work.

In the last two editions of the compilation, Prof. H. J. Gilkey, Head, Department of Theoretical and Applied Mechanics, Iowa State College, assisted by his associate, Dr. Glenn Murphy, has cooperated closely and the value of the publication has been considerably enhanced by their useful contributions.

Other A.S.T.M. books, too, are serving a definite need in many defense courses. The Symposium on Radiography and X-ray Diffraction Methods has been in quite wide demand; also special compilations of standards covering such fields as petroleum, cement, and other tems.

While it is not particularly inspiring from the humanitarian standpoint, at least, to consider that it is a wartime need that has given these A.S.T.M. books such prominence, regardless of their peacetime application it is significant that they are ready at hand for all those who have use for them in supplying authoritative data and information on the subject of engineering materials of such vital concern to all right now.

Mobilizing Materials for Defense[1]

By John H. Van Deventer[2]

In addressing this distinguished audience of technical specialists on the subject of Materials for Defense, let me say at the start that there is not very much that I can tell any one of you about his particular business. You represent the last word in so many varied fields of material research and control that it would be redundant to attempt to add another one.

What I am going to attempt, is to tell you something about the other fellow's business, as applied to materials, and how this affects your business.

In normal times, each of you gentlemen minds his own business but today you must mind someone else's, the someone else being Uncle Sam. And he in turn has been forced to go into a new business and upon an unprecedented scale by an overseas competitor named Adolf Hitler.

Hitler, I think you must admit, is a remarkable man. With a total German population of 79,600,000, he has been able successfully, thus far, to challenge the productivity of the United States, England, Canada, France, Belgium, Poland, Czechoslovakia, Norway, Greece, and points East, West, North, and South.

How has he been able to accomplish this miracle? It is true that he has a remarkably capable general staff to advise him on military strategy. It is true that he had the jump on the rest of the world by from five to six years in organizing production for war. But these are not the basic reasons for his performance. The big basic reason is that Germany, in spite of or perhaps because of her limited natural resources, has led the world in the organization and management of materials control.

Management and Control of Materials

Germany had the benefit of experience in the conservation and use of materials during the last war. Witness the "Ersatz." Little did we think then, that, blessed by a superabundance of natural resources, we would ever come to the point of substitutes.

Management and control of materials! Gentlemen, that is your function.

In the evolution of an industrial product, whether it be for peace or war, there are three primary steps:

First is the discovery of the material.

Second is its "reduction to practice" by applications.

Third is its qualitative control.

From the standpoint of industrial progress, the third step is the most important. And that is where you come into the picture.

Let me repeat: The qualitative control of materials, from the standpoint of industrial progress, is even more important than their discovery and application.

When Adam arrived on earth, and until he left it, he was a vegetarian both as to dress and diet. And there was then no industry. Yet there *was* then as much or even more iron ore and coal underground; as many potential horsepower of waterfall and stream; all of the myriad materials for building cities and motor cars and even munitions were there under his feet or surrounding him above the earth's surface, but unseen and unknown for many centuries to come.

Even had Adam and his sons known about these things, even though they had been able to dig into the earth and produce the ore, or to dam the streams in crude fashion, there could be no progress until they had learned how to measure and control them.

That knowledge had to wait upon the passing of 70 centuries.

It had to await the coming of age of the engineer, with his microscope and his galvanometer; his crucible and retort; his precision balance and his standardized measures of dimensions.

It is not a mere coincidence, in my opinion, that the so-called machine age, which includes the electrical age and the chemical age, was ushered into being in 1870 under the concomitant beginnings of the scientific control of materials through testing and inspection.

It was then that the giant foot began to press down upon the accelerator of industrial progress, initiating that continuous pick-up that today whirls us past the mile posts at such a dizzy speed.

Sometimes I wish that I had lived in those quiet and peaceful pre-machine age days when men simply cut one another's throats with knives or pierced each other with arrows and spears. But then, when I turn the hot water faucet in the bathtub or push the electric light button, I conclude that the bombs and torpedoes of a later day civilization may have their compensating advantages.

However, the modern demand of Mars for materials does put a tremendous task before you gentlemen who are charged with the responsibility of seeing that he gets not merely what he wants but what he ought to have.

But before we discuss your specific problem of today, it might be well to get a perspective of ourselves in relation to time. By that, I mean finite time and not eternity.

Perspective in Relation to Time

We have been living in an advanced state of industrial civilization for about 70 years. You cannot very well call the pre-electric motor age "advanced" from the industrial standpoint.

Compared with about 7000 years of recorded history, this means that we are rather new at the game. Mankind has, in other words, spent only one per cent of his time in a modern scientific industrial environment. In other words, he is just beginning. That ought to be encouraging to you here who comprise the younger generation. There is a good deal ahead of you in the way of work still to be done.

Putting this another way: In spite of all of the textbooks we have studied, all of the chemical and physical and dimensional specifications that we have written, all of the tremendous variety of techniques that we have evolved, there is still much more that we do not know than that we do. That is something to keep in mind now

[1] Presented at the Forty-fourth Annual Meeting, Am. Soc. Testing Mats., Chicago, Ill., June 23–27, 1941.

[2] President and Editor, *The Iron Age*, New York, N. Y.

when we face the tremendous task of mobilizing materials for defense or perhaps for war.

The open mind is the most vital ingredient in meeting an emergency. We can profitably, in normal times, standardize our elements of construction. But we cannot afford, in these days, to freeze our thinking, even for a moment. If we do that, we are beaten.

This does not mean that the great body of established practice that you gentlemen have developed must be thrown out of the window. For that too would be fatal. It simply means that we must now, more than ever, keep the door open for improvement. It means that we must accelerate that part of our thinking and our doing that has to do with the control of the new rather than the control of the old. For this war will be won by something new. Hitler's remarkable performance to date has demonstrated that fact.

This something new may not be and probably will not be a spectacular new weapon of destruction. More probably it will be something new in the management of materials that will enable us to bring to bear, more effectively in production, the overwhelming superiority that we possess in natural resources.

That is the big job that faces you gentlemen who are the custodians of materials.

The Big Job

How big is this job?

There is only one man in the world that knows the answer to that question. That man is Adolf Hitler. He knows what he can do and we have to do just a little bit more than he does.

We may not like to admit it, but it is a cold hard fact that Hitler, today, is dictating and directing the industrial program of the United States of America.

Nobody else but Hitler, for example, has compelled the machine tool building industry of America to expand its output sixfold during the past five years.

Nobody but Hitler is responsible for the drastic expansion of our aluminum industry. It was Mr. Hitler, and not President Roosevelt, who called for the Gano Dunn report on our steel-producing capacity. It was Mr. Hitler, not Mr. Henderson, who made necessary the establishment of price ceilings in this country. It is Mr. Hitler and his subordinate Mr. Udet, chief of aircraft engineering in Germany, who initiates our aircraft design and who recently caused 136,000 changes to be made in a single model of an American fighting plane to gain, among other things, an increase in air speed of three miles per hour.

From now on you are working for Adolf Hitler, and he is a tough boss. You are working for him because you are working against him, and in this industrial world of ours, in peace or war, competition dictates your activities.

So Mr. Hitler says to Uncle Sam: From now on, you must divert 40 per cent of your national effort to the preparation for war and defense. You must operate your steel industry at 100 per cent capacity and expand that capacity, even though your peacetime utilization of it for a decade has not averaged 70 per cent. You must produce 100 million pounds of aluminum per month for your aircraft program, which is to be expanded from its 1800 unit production in 1938 to a 50,000 unit production in 1942. You must induct 5 million more workers into your defense industries, even though you have to comb the interval between the cradle and the grave to find them. You must triple the tax taken from your business and industrial units and your individuals and on top of that put two future generations in hock by boosting your national debt to 100 billions. You must induct the flower of American youth into army camps at $21 per month and leave the flat footed and the toothless at home to strike for higher wages.

Some job this man Hitler has laid out for us! Let me illustrate it, quantitatively, by measuring just one little part of it.

Some weeks ago, as you will remember, our President raised the ante on four-motored heavy bombers to 500 per month, or 6000 per year. That, of course, is but one part of our aircraft program, which in turn is but one part of our defense program.

After a recent thorough investigation in the industry, I ascertained that when these heavy bombers get into real production instead of being made by hand as they are now, the time required to complete one of them will be 150,000 man-hours. Thus 6000 bombers a year, which is the program as it is at present, will call for the expenditure of 900 million man-hours. At 2000 hours per man per year, this in turn will call for the employment of 450,000 workers, or more than are now employed in the entire automobile industry.

The construction of these heavy bombers, which, mind you, is but a fraction of a fraction of our defense program, will call for the utilization of 276 million pounds of materials—materials such as aluminum, magnesium alloys, high grade castings and alloy steels so far above the ordinary run-of-mine materials that we measure them in pounds instead of tons. Of the amount, 100 million pounds will consist of aluminum.

When I say to you gentlemen who are the custodian of materials, that you will have to "bust" some suspender buttons to do what Mr. Hitler has laid out for you, I am understating and not overstating the case.

However, let me say at this point that while material shortages may be and will be the initial choke points, in the long run these will run third in importance. As this program develops, the most serious shortage will prove to be in man-power and the runner-up will be horsepower. Given enough of these two, the materials can be made forthcoming.

Present Situation of Defense Materials

At this point it may be interesting briefly to review the situation regarding the most common of our strategic defense materials.

First as to steel.

So far as over-all capacity and production are concerned, and our ability to meet requirements, you have your choice of two viewpoints.

First is that of Stacy May, economist of the OPM, who has calculated that to meet all demands in 1942, our steel industry should have a practical capacity of 120.4 million tons per annum.

Or you can take the viewpoint of Gano Dunn, the eminent engineer and adviser to the President, whose latest report shows total steel requirements for 1942 as 97.5 million tons, or 6.4 million tons above the indicated

practical capacity as of that year. You have quite a latitude of choice in this difference of 23 million tons.

You also have an interesting sidelight in these varying estimates on the difference between theory and practicality and upon the impending shortage of manpower. For, as Mr. Dunn points out, if we had 120 million tons of steel available in 1942 we would not know what to do with it, since it would require an additional labor force of 6,000,000 workers for its production and fabrication.

But, after all, the answer is not in the total ingot production so much as it is in being able to get the kind of steel that you need when you need it. And the chief stimulation of steel demand in defense makes itself felt in our alloy steels.

In these categories are the open-hearth and the electric furnace alloys. There is plenty of open-hearth capacity for the production of the low alloys, provided we divert existing capacity to that use. And electric furnace capacity is being rapidly expanded. However, adequate capacities are useless unless we can obtain a sufficient supply of the alloying materials. You cannot make bricks without straw or nickel steel without nickel.

Nickel:

From the standpoint of steel making, as well as other requirements, the nickel choke point is one of the worst that we have to contend with. In fact the nickel industry is a series of choke points. Ore reserves are present to cover almost any desired output but shortages exist in hoisting facilities, in concentrating plant, in smelter, and in refining capacity.

To open up all of these choke points sufficiently to permit a flow of enough nickel for defense and civilian requirements would take from two to three years. The abolition of these choke points is still largely in the planning stage and for some months to come there will probably be a complete cessation of use of nickel for civilian purposes.

Work being done in the automobile industry to eliminate or minimize the amount of nickel used in passenger cars, in general, consists of substituting non-nickel steel alloys for those of nickel; taking out the nickel used in certain cast irons; eliminating or reducing the amount of nickel used as an under plate in chromium plating; and in some instances dispensing with the plating entirely. Several companies report that 80 per cent or more of the nickel will be eliminated from their cars. Replacing the nickel steel alloys is proving the biggest job because of the modifications necessary in machining and heat treating and sometimes in the design of the part itself.

Nickel steels were fostered by the automobile industry because of their toughness, hardness, and resistance to shock. Recent trends in design of power-transmission systems, such as the use of fluid flywheels and synchromesh transmissions, have all been in the direction of eliminating jerks or shocks. For this reason the trend toward replacing the nickel alloy steels with those of carbon-molybdenum, chromium-molybdenum, manganese-molybdenum, carbon-manganese, or high-tensile low-alloy steels and variations of these started some time ago so that some cars today (like Chrysler, for example) have few nickel steel parts left. Those companies that still retain them did so more for their production economy than because of their extra shock resistance and hardness. Usually the nickel steels are much more readily machinable than those of the other alloy grades.

Corrosion- and heat-resistant steels (stainless) containing about 18 per cent chromium and 8 per cent nickel have been used on many lines of passenger cars for exterior moldings and trim. *All these steels are being eliminated.* In their place some companies are substituting corrosion-resistant steels containing about 18 per cent chromium. Others are replacing them with carbon steel chromium plated; still others are contemplating eliminating all the molding and trim.

In the stainless steel industry, practically all analyses involving nickel are now going exclusively into armament use. The nickel situation in this industry has precipitated the adaptation and development of substitute steels many of which have for some time commonly been applied in England and on the Continent; for instance, American makers are now turning out considerable quantities of type 431 stainless steel which contains 16 per cent chromium and 2 per cent nickel, but has a performance value almost equal to the standard 18–8 analysis. This steel is rather difficult to make and heat treat, but producers are solving these problems quite rapidly. The scarcity of nickel has also encouraged American makers to consider other modifications of the chromium-nickel and straight chromium analyses. One of these alloys is the chromium-molybdenum type which frequently has titanium additions to minimize grain coarsening on welding. Many producers in this country are now turning out chromium-manganese steels, particularly for food handling, cutlery, etc. Such steels may have anywhere from 8 to 18 per cent chromium and 8 to 18 per cent manganese. These steels have a sheen not unlike that of silver, which has encouraged their use for cutlery in Germany for some years. There is also work being done in the development of heat-resistant steels containing no nickel whatsoever.

Molybdenum:

In the whole question of strategic metals, the metal molybdenum is more and more frequently run across as a factor tending to relieve pressure on other metals. The use of molybdenum for many purposes has developed since the last war. For instance, molybdenum high-speed steels have taken a considerable load off of tungsten-bearing high-speed steels; molybdenum is increasingly used in stainless steels, sometimes to supplant nickel, and molybdenum is finding growing application in S.A.E. steels frequently as a partial substitute for nickel.

Chromium:

Another important alloying element is chromium. Although the use of chromium is coming under increasing surveillance by the Government, the situation here is not too discouraging. American users have almost a two years' supply on hand and considerable material is still being imported. Of course, the very high-grade Turkish deposits are no longer generally available, but the equally high-grade New Caledonian deposits coming from a territory under the jurisdiction of de Gaulle will be available just so long as shipping facilities permit. Both Cuba and the Philippines have shown considerable promise as chromium producers, and there are numerous undeveloped

fields in Brazil which are, however, unfortunately not very well serviced by transportation facilities. If the situation should get very tough for this country we could, of course, handle our own low-grade chromium deposits, but this is an expensive procedure, and no one currently shows much inclination to get involved in such an enterprise.

Tungsten:

The situation in tungsten, although very tight, is also not particularly serious. The tremendous load thrown on the machine tool industry has naturally thrown a similar load on tungsten-bearing cutting steels, but this situation is somewhat mitigated by the increasing acceptance of molybdenum high-speed steels. A rather unexpected load was thrown on the tungsten supply since the start of the war. The growing use of armor plate in aircraft and the use of armored ground equipment have necessitated the use of armor piercing machine gun bullets and larger shells. The machine gun bullets, for instance, all carry a core of 4 per cent tungsten steel, and since these bullets are made literally by the tens of millions, it is obvious that the drain on tungsten supply is no negligible factor. The Government is making determined efforts to bring in increasing supplies of tungsten from China, and, if necessary, our domestic tungsten enterprises could take an increasing load if properly subsidized or if the market price permits.

Manganese:

Manganese is one of the most important strategic materials. About 14 pounds of the metal are needed for each long ton of steel produced.

This country has been dependent on distant sources for about 95 per cent of its needs, with Russia, the African Gold Coast, and India sending some 70 per cent of the imports in recent years. With the outbreak of the European War the United States was stimulated to rather belated action in accumulating a stock-pile for possible emergencies that might interrupt supplies from the three major sources. In such event, imports from Brazil, Cuba, and Chile, plus a small domestic output, would not meet the country's needs. However, from the viewpoint of stocks on hand there seems to be no need for worry regarding the manganese situation during 1941.

In 1942, particularly if the war spreads throughout Africa and the shipping situation becomes acute, there can well be some tightness in this metal. There are several ways for such potential tightness to be relieved. Under the stimulus of liberal R.F.C. loans, there are numerous new processes in various stages of development for the concentration of low-grade manganese ores found in large volume in the United States. Also, the production of electrolytic manganese (of extremely high quality) in this country from low-grade ore is quite successful. With much greater production, perhaps this process could compete pricewise. Also, the U. S. Steel Corp. owns Brazil's largest manganese mine, and stocks underground there could supply this country for many years. The comparatively short railroad haul to the coast from this mine, however, is extremely difficult, what with both rolling stock and roadbed in no condition to handle much traffic. In line with the Good Neighbor Policy, however, it might be expedient to rebuild this railroad.

Cobalt:

The development of sintered carbide tools since the last war, of course, has helped to take some of the load off of high-speed tungsten-bearing cutting tools. Just to show how one metal is so intertwined with another, however, it might be pointed out that in the case of sintered carbide, considerable cobalt is required and this again is an imported material and one which could have been seriously scarce. Thus far cobalt has principally come from refineries in Belgium, the ore originating in Africa. However, one refinery has been built in this country and with ore coming to it from Africa this situation seems to be moderately well in hand.

Copper:

Among the non-ferrous metals and second only to aluminum in importance as a strategic material is copper.

At the present time, all of the low-cost American producers of copper as well as some of the marginal producers are operating at capacity, at the rate of about 1,000,000 tons per year. In addition, we are buying every pound of copper that South America will produce, about 500,000 tons per year. Our present demands for defense and civilian needs are estimated at about 1,800,000 tons per year. Hence the coming pinch to the tune of about 300,000 tons, on paper, but really more in actuality, as shortage of bottoms seems to be preventing the South American copper from reaching us. Domestic refinery capacity might be pushed to 1,500,000 tons per year, and mine output increased sufficiently to supply it, by increasing the price sufficiently to let in high cost producers, but the most constricted choke point at this time is shipping.

Relief cannot come from only one source; it must consist of more ships, increased mine output, and perhaps also greater refinery capacity. Otherwise a squeeze is directly ahead of us.

Zinc:

Zinc is one of the tightest choke points, due to (1) insufficient ore which can be mined at present prices, and (2) lack of refinery capacity.

At the present time ore is available in sufficient quantities to keep zinc refineries operating at their maximum, by importing concentrates from Mexico, Canada, Newfoundland, Peru, Argentina, Bolivia, and Australia. At higher prices more domestic ore would be forthcoming.

According to the American Zinc Institute, the industry is expanding present refineries, rehabilitating unused or dormant plants, and constructing new plants at a rate which it is estimated will in 1942 provide ample slab zinc for United States, British, and other nations' defense needs and for nondefense uses to approximately 75 to 80 per cent of the slab zinc consumed in this country in normal years by all industries. It is expected that in 1941 the production of slab zinc will total over 900,000 tons and in 1942 close to 1,000,000 tons, compared with 724,000 tons in 1940, 557,000 tons in 1939, and 478,000 tons in 1938.

Cadmium; Tin; Lead; Antimony:

Cadmium is in a strained situation, being available only as a by-product of zinc. Only as zinc production increases will cadmium output rise.

Tin, originally looked upon with most fear, is in better shape at this moment than most other metals. Consumers seem to have one to two years' supply on hand, and shipments are coming with reasonable regularity from the Dutch East Indies and Britain.

Prospects are not bad; tin is now smelted in this country in increasing though small tonnages, and at this moment no immediate pinch is anticipated.

No shortage exists in lead at this time. Our domestic mine output is insufficient to take care of defense and civilian needs (about 40 per cent of our consumption is obtained from Mexico, Peru, Canada, and Australia) but smelter and refinery capacity are still adequate. Increased demands may develop, however, which will call for an increased tonnage of ore, which will be obtainable from domestic sources only at higher prices.

Although antimony is on the inventory control list, no excessive stringency is felt at this moment. American production has come in to take over a large part of our demand and metal is still available for civilian as well as defense needs.

Mercury; Platinum; Silver:

As to mercury, foreign material which formerly came from Spain and Italy has disappeared from the American market, for perfectly obvious reasons. American consumption, which has more than doubled in the past year, is now being supplied entirely by American sources. At this time we are somewhat behind our domestic needs for defense and civilian requirements, but ore reserves are ample and refinery capacity is rapidly coming up to presently estimated requirements. With prices at present levels, mercury will continue to be available.

There is no real shortage in platinum today even though practically all of our metal is imported. To some extent, this fortunate circumstance is due to the fact that platinum, as a by-product of the nickel ores in Canada, covers about 25 per cent of our needs, and since nickel production is under maximum pressure, platinum will continue to be available.

There may be some shortage in iridium and osmium, not because of the lack of supplies, but because their use as contacts in airplane engines has been expanded out of all proportion and their availability is limited by the output of platinum.

Silver offers no problem. We have more than we need or are likely to need for this war or any other conceivable emergency. The problem is to find industrial uses for a "precious" metal. This same statement might well apply to the gold buried at Fort Knox.

Aluminum; Magnesium:

Due to the requirements of our aircraft program, aluminum and magnesium present the most acute shortages of the important metals. For the next two years almost the entire supply, if not all of it, will be required by the air industry.

Just how long we will be able to say "There is no shortage of aluminum for national defense" is problematical. There may be a shortage next month, in six months or in a year, depending upon the rate of acceleration of plane building, in Britain as well as in the United States.

Aluminum production in the United States during 1939 was 327 million pounds. Domestic production at present is at a rate of approximately 600 million pounds per annum. By July, 1942, it will reach a rate of 825 million pounds.

Even then it will fall far short of requirements, for W. S. Knudsen has estimated that our expanded plane program will require an annual rate of 1.6 billion pounds, or more aluminum than was produced last year by the entire world.

Until recently, the Aluminum Company of America was the sole producer of primary aluminum in this country. By July of next year it will have completed a defense program enlargement that will more than double the capacity that has been built up during the past 50 years. Its capacity will then be 720 million pounds per annum. Incidentally, this expansion has cost the Aluminum Company $200,000,000.

Reynolds Metals has recently come into the picture as a new producer of aluminum, having been granted a loan of $20,000,000 from the R.F.C. for that purpose. The Eastern plant of this company, at Lister, Ala., is now in production and will turn out raw aluminum at the rate of 40 million pounds per year. The Western plant at Longview, Wash., will be completed by the middle of 1942 and will have a capacity of 100 million pounds annually.

So far as finishing capacity is concerned for aluminum, there is no apparent shortage, this being on the order of 75 million pounds per year. Not much addition will be necessary as much of the difference between producing and finishing capacity will go into castings.

The problem of substituting other materials for aluminum is difficult because of weight and strength qualities. Experiments and tests are now being conducted in the use of stainless steel for airframe members of military aircraft. Here again, however, we encounter the shortage of nickel.

One of the principal savings indicated is in the use of cast iron instead of aluminum for automobile motor pistons. This change-over involves many headaches, and considerable re-design. Also it requires new tooling setups, and machine tools are hard to get. One automobile company has just spent $750,000 for new tooling equipment in anticipation of this change-over.

Secret research is now being conducted looking to the possibility of using plastics for pistons, but no results have yet been disclosed.

Substitutions for aluminum which have reached or now approach the quantity production stage include tinned copper and steel for ice-cube trays, enamel on steel for cooking utensils, bakelite for washing machine agitators, injection plastics for vacuum cleaner parts, electric tool handles, automobile car door handles, camera parts, vacuum bottles, etc. In most of these cases, the resulting cost has been lower.

Magnesium is in an even less encouraging position than aluminum, in spite of the fact that the Dow Chemical Co. has made a fourfold expansion in capacity since 1939 and will shortly put into operation its second plant for the extraction of magnesium from salt water. However, since the British have been progressively adopting magnesium as a bomb material, the requirements have multiplied much faster than any possibility of supply.

Conclusion

All of the above statements are predicated on present estimates of defense needs. As you are aware, these are by no means static.

In general, greater tonnages of American ores are available in copper, zinc (and cadmium), and lead, at prices which will permit high cost producers to operate. Aluminum, magnesium and nickel ore reserves are ample, and American antimony and mercury are also doing well. Tin is in a better position than expected and the problem in the precious metals is not pressing.

Constriction, in varying degrees of severity, exists in refinery capacity of copper, zinc (and cadmium), aluminum magnesium, and nickel.

Probably the worst single choke point is shipping which, among other things, has been seriously interfering with the accumulation of Government stock-piles.

Plastics:

One of the most interesting developments of substitutes for metals has been in the field of plastics. Unfortunately, however, the normal growth of the plastic industry, with its broad opportunity for applications, has been so rapid as to keep pace with capacity. Already, for instance, a pinch is being felt in the production of formaldehyde.

Under these circumstances, there will probably be a diversion of plastic capacity from normal consumer products to those military or industrial uses for which this material is suited.

Considerable space has been given in the newspapers to the possibility of making plastic wings and air frame parts and also plastic car bodies. The difficulties involved in this are such that there is no likelihood of any effective results being secured within the next several years, probably not in time for this war.

Wood impregnated with plastic material is being used in England for the construction of aircraft stamping dies. The life of these dies on aluminum sheet is from 2000 to 2500 pieces. In Germany, it has been found possible to replace tin and lead coatings on collapsible tubes with plastic varnishes. Molded mudguards are used at present on motorcycles and in Germany, also, molded phenolics are being used in the manufacture of carburetors. In that country, too, plastics are being used to make handwheels for brakes on railway cars and even hub liners on locomotives.

In the direct munitions field, chests, packing cases, assault boats, lockers, and fuse caps have all called the various plastic materials into service. The need for unshatterable windshields for aircraft has also stimulated demands upon this industry.

So much for materials. From what I have told you about them, I think that you will agree that there is a pinch coming. When this defense program gets into full swing, as it will during the next six months, the question of guns *versus* butter is undoubtedly going to be answered in favor of guns. And that means less butter.

Higher Prices:

A second observation that I think is logical is the inevitable coming of higher prices. Even if these are not forced by labor rate increases, they will be by the necessity of preserving the status of marginal producers and of bringing into the market domestic ores whose production cannot profitably be attempted at present price levels. Already we have the anomaly of a two price system in the steel industry. One price ceiling for the boys who can still make a profit and another and higher price ceiling for the boys who can't!

All of the choke points that we are meeting do not have to do with deficiencies in our producing units. In some instances the trouble seems to be scarcity of judgment rather than of materials or productive capacity.

Importance of Good Judgment

In spite of the drastic aluminum shortage, for example, military authorities recently have ordered several hundred thousand aluminum water pitchers for army use. We can't throw these at Hitler.

In spite of the drastic nickel shortage and an impending shortage of copper, the Senate a few days ago passed a bill nearly doubling the revolving fund used for the purchase of these metals for nickels and pennies.

A large shell plant making projectiles of heavy caliber has recently been forced to suspend operations because the Government could find no proper place in which to store the output, and shells that are left out in the rain are good only for the scrap pile.

A maker of light armor plate, of which material thousands of tons will be required, is approaching a shutdown because it cannot get word from Washington as to the specifications for the next order.

One of our shipbuilding concerns is working on an order for forty 110-ft. submarine chasers. The hulls are made of plywood which could easily be penetrated by a 22-caliber bullet. Yet the portholes are fitted with heavy bullet-proof glass and encased with heavy aluminum frames.

The machine tool industry has expanded its output five or six times beyond normal in the endeavor to keep up with defense requirements. But machine tools are useless without small tools with which to do the cutting of metal. And cutting tool production capacity has hardly doubled. It has been reliably figured that the making of one large airplane engine represents the complete consumption of $500 worth of small tools. Thus when our aircraft program gets in full swing, it will take the entire present and projected small tool capacity of this country to fill its needs, leaving nothing over for guns, ammunition, tanks, locomotives, freight cars, motor trucks, and the thousand and one other products that require machining.

Progress—Competition

Fortunately, however, in spite of our shortages in materials and in mind power, we are making progress. Blunders are inevitable in war and wars are won not by being perfect but by making less mistakes than the other fellow does. We do not hear of Hitler's mistakes because he does not publish them. Undoubtedly he is making them.

This war is essentially a competition between nations in the production and utilization of materials. I think that America is fortunate indeed to possess the asset of mind-power represented by your distinguished society. As the result of your constant cooperative studies and your research we have put America at the forefront of the world's peacetime industrial procession. And now, in these critical times, you are gathered here to put and keep us in the same outstanding position for defense.

I know that you will do that job and I wish you Godspeed in its accomplishment.

The Measurement of Earth Pressures on the Chicago Subway*

By Ralph B. Peck[1]

For many years there have been earth pressure theories from which calculations have been made of the expected pressures against the temporary bracing of open cuts. On numerous occasions unfortunate accidents indicated to construction men that the pressures actually experienced were often quite different from those predicted by the theories. This situation led to a separation of theory from practice in this particular field of earthwork engineering. Practical men designed bracing on the basis of experience, frequently with small use for theory. Men with less experience continued to use or to modify theories without regard for the evidence found in the field regarding their shortcomings. Neither course proved successful and failures continued to occur.

With the better understanding of earth pressure problems which came about after the introduction of soil mechanics, attempts have been made to measure the actual lateral earth pressure against existing structures and to correlate the results with theory. In addition to the earth loads, in order to establish the correctness of modern earth pressure theories, it has also been important to learn the manner in which the soil deforms during the excavation process. This paper is intended to present the methods used to determine the earth pressure acting in existing open cuts, and the coincident soil movements. No attempt will be made to state the results of the investigations or to draw any conclusions regarding the relationship of measured to calculated earth pressures. The techniques presented are given in the hope that men who are associated with the construction of open cuts will be impressed with the comparative simplicity of the determination of earth pressures, and will be led to make measurements of their own in order to add to the common fund of engineering knowledge. Individuals who carry out this program will doubtless be repaid by gaining a definite knowledge of the safety and economy of their structures.

Historical Review

The first recorded measurements of the earth pressure against temporary bracing in an open cut are probably those performed on a wide trench 80 ft. deep in Brooklyn, N. Y., in 1916. The sheeting for this excavation was braced with wooden wales and struts. Measurements were made of the pressures acting against two panels. A thread was stretched over a short length of each wale on its neutral axis before and after the wale was subjected to stress, and offsets from the thread to the inner face of the wale were determined. By the use of an assumed modulus of elasticity for the wood, it was possible to calculate the average intensity of pressure necessary to produce the measured deflection in the wales.

Although the observations were crude they were sufficient to show that the resultant earth pressure acted at a point near the mid-height of the cut rather than at the lower one-third point. Reliance on the calculated values of the earth pressure, however, is not justified because of the assumption that the lateral pressure was uniform along the length of the wale. As a matter of fact, it was certain to be somewhat greater near the points where the rigid struts were attached than near the center of the wale. As a result, the deflection of the wale was smaller than it would have been if the earth pressure had been actually uniformly distributed in the horizontal direction. To eliminate this uncertainty, it is necessary for quantitative study that the loads in the struts rather than in the wales should be determined.

The first tests to determine the loads in the struts of an actual excavation were probably those conducted by the firm of Mason & Hanger, during construction of the west cofferdam of the George Washington Bridge. This structure was braced with wooden struts into which copper tacks were driven about 30 ft. apart. The distance between the copper tacks was determined with great care with an ordinary steel tape, making corrections for pull and temperature. The load in each strut was computed from the observed axial shortening, again assuming a value for the modulus of elasticity of the wood. Since this quantity is not only somewhat variable for different portions of the same timber but is also subject to variation with moisture conditions, and with long periods of subjection to stress, results based on its use are likely to be quite inaccurate.

The next important step in the measurement of earth pressures in a cut with wooden bracing was made by the Siemens Bau Union in 1936. During the construction of a portion of the Berlin subway in a 38 ft. deep open cut in sand, a disastrous collapse took place. In the ensuing controversy Dr. Terzaghi pointed out the likelihood, based on the results of theoretical considerations and laboratory experiments, that arching of the sand behind the bracing was taking place and that the center of pressure was, therefore, considerably above the lower one-third point of the height of the cut. A series of tests was made to determine the load in the struts in six profiles by means of hydraulic jacks equipped with a pressure gage. The struts were constructed in short lengths separated by channels, as shown in Fig. 1. The jacks were inserted between the backs of the channels. When load was applied to them the pressure in the spacer block between the strut ends was reduced, until eventually the entire strut load was carried by the jacks. As long as the pressure in the jacks did not exceed the load in the strut, the distance between the backs of the channels changed a very slight amount, as shown in the curve in Fig. 1 (*C*). After the load was entirely transferred from the spacer block to the jacks, as jacking continued the load in the strut began to increase and the struts shortened under axial compression. The rate of deformation between the channels then increased. The projection of

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* Presented at session on Subways and Superhighways, held jointly with the Western Society of Engineers, at the A.S.T.M. Annual Meeting, June 24, 1941, Chicago, Ill.

[1] Assistant Subway Engineer, Department of Subways and Superhighways, City of Chicago.

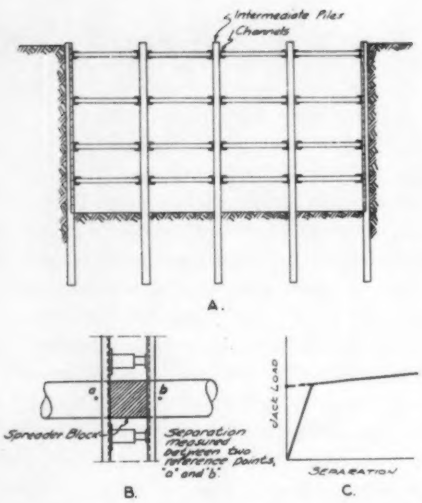

Fig. 1.—Strut Load Measurement, Berlin Subway.

the latter portion of the load-deformation curve to the axis of zero deformation permitted the determination of the strut load before jacking took place.

The results of the observations showed without a doubt that the arching phenomenon actually occurred. They also established the validity of the general wedge theory of earth pressures for open cuts built in sand.

The design of the bracing for most American open cuts does not include details similar to the channels with spacer blocks, which were used on the Berlin subway. It has been, therefore, necessary to find some other procedure for transferring the load in the struts to the jacks. Probably the first use of the jacking technique in this country was made by the firm of Spencer, White & Prentis, in connection with the Sixth Avenue Subway in New York City. In this case the struts were steel H-beams placed with their webs in a vertical position. A pair of 40-ton hydraulic underpinning jacks was placed in a horizontal position, one on each side of the web at the end of the strut. A pair of wedges was placed behind each jack in such a manner that the jacking load would expand the wedges against the inside of the beam flanges, as shown in Fig. 2. The loads in the struts were comparatively small and the procedure was used with success. In this case, however, the time when the end of the strut had just separated from the wale against which it was bearing was determined by the change in tone emitted when the steel strut was struck with a hammer. It is possible that an error was introduced by this procedure, as well as by the failure to take into account the effect of friction in the hydraulic jacks.

Several improvements on the procedure used by Spencer, White & Prentis were made in connection with measurements of earth pressures at the site of the New England Life Insurance Co. Building, in Boston, Mass. These measurements, conducted by Arthur Casagrande and Ralph E. Fadum of Harvard University, and Langley S. Homer of the Turner Construction Co., were made in

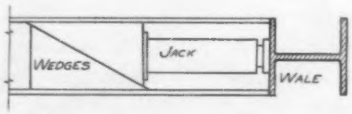

Fig. 2.—Method of Jacking, Sixth Avenue Subway.

1939, simultaneously with some of those to be described later for the Chicago Subway. Although the loads were small, 40-ton underpinning jacks were used, and wedges were placed between the flanges of the struts to serve as a reaction. The improvements in the procedure consisted of the introduction of a 0.001-in. dial gage for measurement of the separation between the end of the strut and the concrete block against which it had bearing. During erection of the bracing, small fillers were placed between the end of each strut and the strut bearing block. These fillers were removed during the jacking process so that the end of the strut could be jacked back and forth through its original position. This provided a very accurate means for determining the initial load in the strut.

Measurements of the earth pressure carried by the individual pieces of horizontal sheeting were also made on this project. The sheeting which was customarily supported against the inside flanges of vertical H-piles was set back in a test panel so that calibrated steel springs could be inserted between the sheeting and the flanges. The deflection of these springs was measured by means of an extensometer dial and served as a measure of the pressure acting against the sheeting. Attempts to measure this

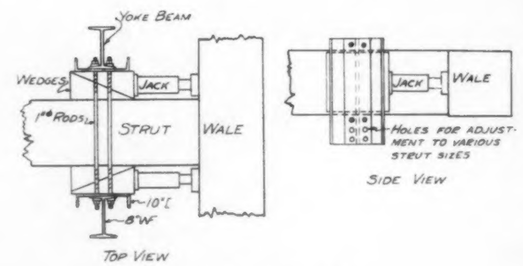

Fig. 3.—Loading Yoke.

pressure by means of the deflection of the wooden sheeting itself were abandoned after calibration tests were performed on the sheeting. The calibration indicated that the load necessary to deflect the sheeting an amount comparable to that expected, decreased from its original value to two-thirds of that value within a period of 100 hr. These results indicate the type of error associated with deformation measurements on wood members such as were performed in Brooklyn and on the George Washington Bridge.

Earth Pressure Measurements on the Chicago Subway

In connection with the construction of the Chicago subway a number of open cuts were constructed varying in depth from 36 to 46 ft. In each of these, measurements of the strut loads were performed. For measurement of the strut loads in cuts having wooden bracing, a modification of the jacking procedure was developed. For measurement of the loads in steel struts which carried over 200,000 lb. each, the use of a strain gage was adopted. For cuts braced with steel struts, in which the expected load was less than 200,000 lb., the jacking technique was usually used.

Development of Jacking Procedure:

The first opportunity for the measurement of strut loads occurred in connection with a cut possessing wooden struts varying in size from 10 by 10 in. to 14 by 16 in. The cut was nearing completion at the time the measurements were

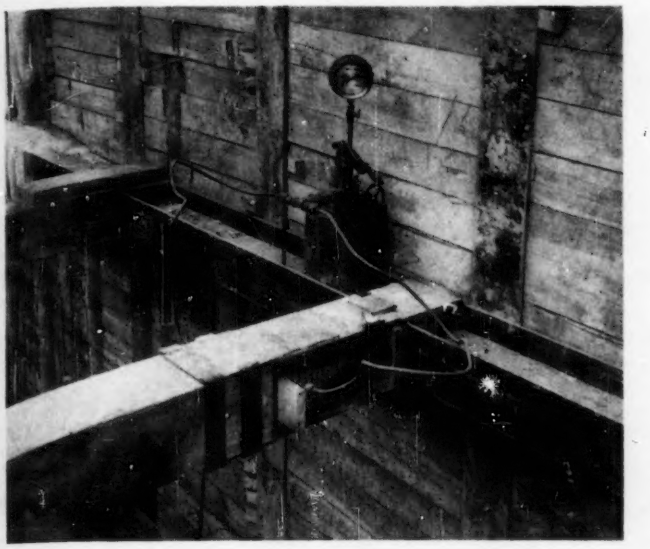

Fig. 4.—Showing Use of Steel Strut Shoe.

undertaken. Two jacks, a pump, and a pressure gage were secured, and a yoke was developed to permit the transfer of load from the jacks to the strut.

The loading yoke is shown in Fig. 3. Its purpose was to clamp wedges against the sides of the strut in such a manner that the load from the jacks could be transferred through the wedges and yoke to the strut. It was soon found that even with careful adjustment of the loading yoke and wedges, it was not possible to develop a total load of more than 70,000 lb. in the jacks before the spreading of the yoke would permit the wedges to slip. Since the device was already of considerable weight, it was considered unlikely that any reinforcement would be practical. After several modifications the effort was abandoned and the use of the loading yoke was reduced to the determination of strut loads which did not exceed about 40,000 lb. For these small loads, however, the yoke proved entirely satisfactory and was very convenient. Its great advantage lay in the fact that it could be attached to any desired strut after construction of the cut.

The failure of the loading yoke to be satisfactory for measuring large strut loads indicated the necessity for advance preparation of certain struts. The scheme finally adopted consisted of cutting the strut about 2 ft. short and of fitting a steel shoe over the end. A photograph of the shoe located in one of the open cuts is shown in Fig. 4, and a detail drawing in Fig. 5. In practice, the shoe was placed upon the end of the strut and spiked by the carpenters before the strut was lowered into the cut. The strut with the shoe was then erected in a manner no different from that for any of the other struts. Inasmuch as the jacks within the strut shoe could bear directly on the end of the wood strut, no limit existed for the load except the capacity of the jacks or of the strut.

Certain precautions were found to be necessary in the use of strut shoes and jacking equipment. It was found to be essential that the flanges of steel wales be supported opposite the strut end in order to prevent their distortion by the jacks. Steel stiffeners welded in place, or tight-fitting hardwood blocks, were found to be equally satisfactory. When the wales were made of wood it was found to be necessary to bolt a metal plate 1 in. thick to the

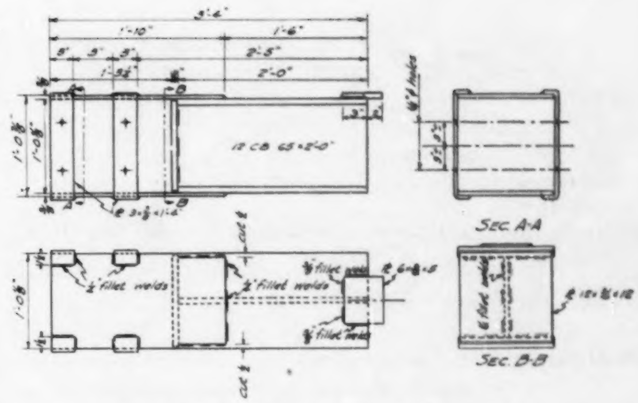

Fig. 5.—Detail Drawing, 12-in. Strut Shoe.

wale to provide bearing. On some occasions the width of the flanges of steel wales was considerably less than the size of the strut. In these cases also, it was necessary to bolt the heavy steel plates to the inner flange of the steel wale.

In order to make a measurement of a strut load, a pair of hydraulic jacks connected to a pump and gage was inserted in the strut shoe. Pressure was applied to the jacks in increments until the end of the strut was free from the wale a distance of about $^1/_4$ in. The load in the jacks was then decreased to zero, by increments. During this process, the separation between the strut shoe and the wale was measured at each of the four corners of the strut shoe. For any of these corners a curve such as shown in Fig. 6 was obtained. In this diagram the separation is plotted as a function of the load in the jacks. The separation itself was measured by means of a dial gage reading to 0.001 in. The gage, mounted on a support, was clamped to the strut shoe near one of the corners. The movable end of the dial was made to bear against an upright metal post which was tightly bolted to the wale. It was found that satisfactory readings could not be obtained if the reference point on the wale was connected to the flange, because of bending of the flanges. Therefore the reference point was attached to the wale at the centerline of the web. This was usually accomplished by burning a hole through the web and bolting a reference bar through the hole. The arrangement is shown in Fig. 7.

The typical curve obtained for each corner of the strut shoe during the jacking operation, as shown in Fig. 6,

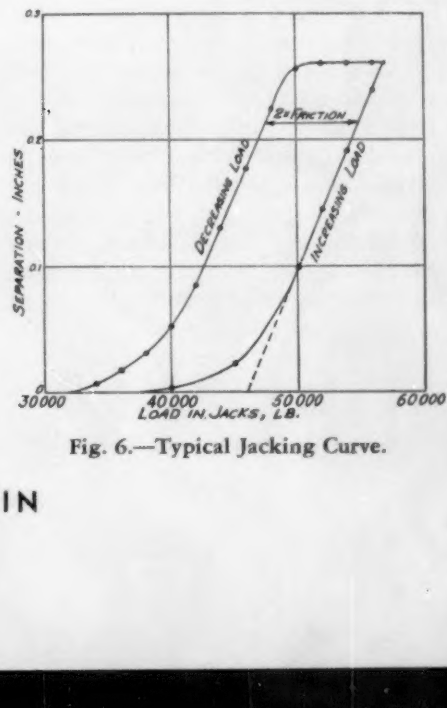

Fig. 6.—Typical Jacking Curve.

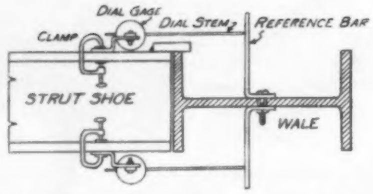

Fig. 7.—Method for Measuring Separation Between Strut Shoe and Wale.

provided the means for determining the load in the strut before jacking operations were undertaken. The projection of the straight-line portion of the curve for increasing load back to the zero-separation axis indicated the load in the jacks at the instant when that load was equal to the original load in the strut. The indicated load was corrected for the friction in the jacks, which was determined by calibration in a standard testing machine to be equal to one half the width of the hysteresis loop obtained in each jacking curve. When the jacking curves for each of the four corners were not identical, the results for all corners were averaged arithmetically. This process was demonstrated to give correct results whenever the strut shoe was short and rigid compared to the strut. These conditions were closely approached in the field. It will be observed that the actual curves did not consist throughout of straight lines but were smooth curves until the entire strut had separated from the wale. The curvature was caused by the fact that the strut ends were not entirely plane and that other points beside the four corners were in bearing against the wale. However, no error was introduced, provided the jacking was continued until the straight-line portions of all four curves were established. It was found that in order to establish the straight-line portion it was in some cases necessary to overload the strut as much as 20 per cent. If the strut had an adequate factor of safety no harmful effects could result from this operation but care was exercised to observe the strut for any signs of distress during the test.

In clay soils, it was thought that the effect of jacking might permanently alter the magnitude of the strut loads. It was found possible to repeat the determination of the load in a strut immediately after completion of one set of observations, with no significant variation in the results, even when the struts were excessively jacked on the first trial.

When it was desired to use the jacking technique where struts were steel, and where the loads were not too great to handle, it was necessary to weld a small bracket with a stiffener between the flanges on each side of the strut. The details of such a bracket, which could readily be installed after the strut was in place, are shown in Fig. 8. Customarily the strut rested upon a seat angle, which was left in place so that danger did not exist of dropping the strut after it had been separated from the wale. Small steel clips or scabs were provided on the strut shoes to accomplish this purpose. The use of wedges instead of a welded bracket was found to result in spreading of the flanges of the strut except for small loads.

Strain-Gage Technique:

When the loads in an individual strut exceeded about 150,000 or 200,000 lb., the weight of the equipment necessary to carry out jacking operations and the precautions which had to be taken to handle such large loads, made the procedure undesirable. In this case the struts were almost certain to be made of steel and the use of a strain gage was found to be satisfactory. For the measurements on the Chicago Subway a 10-in. Whittemore strain gage equipped with a 0.0001-in. Standard dial indicator was used. One division of the dial indicated a unit strain of 0.00001 in. per inch. The dial was read to 0.1 division and under field use readings were repeated until they agreed within 0.5 division. Values of unit strain obtained by the instrument were reduced to unit stress by multiplying by an assumed modulus of elasticity of 30,000,000 psi., and the total load in the strut was obtained by multiplying this unit stress by the cross-sectional area of the strut.

In order to eliminate strains produced by changes in temperature a mild steel reference bar was always used as a standard. This bar was approximately $^1/_2$ in. square in cross-section so that when placed upon the metal of a strut it readily assumed the temperature of the strut. Readings were always made on the reference bar, then on several gage lines, and finally on the reference bar again, in order to check whether any differences in temperature or any changes in the calibration of the instrument had occurred during the readings. Any difference in reading of the reference bar covering a set of observations which was greater than a tolerance of 0.3 division was considered cause to repeat the entire set of observations. The observations were always repeated at least once.

The struts were placed in the cut with their webs in a horizontal position. Gage lines on the struts were located as near as possible to the neutral surface for bending in a vertical plane. They were located in several positions before the most satisfactory method was found. Finally, however, they were always located on the upper surface of the web of the struts. Generally, three gage lines were located near one end of each strut. One of these lines was on the centerline of the strut and the other two were symmetrically placed with reference to the centerline, as near to the flange as was convenient for operation. This procedure permitted the operator to sit or kneel upon the strut while making the observations. It also permitted the reference bar to be read while the operator was in the same position as he assumed for the gage lines in the strut. This method possessed a distinct advantage over the others in the comfort of the operator and resulted in more satisfactory observations. With the strain gage holes in this position, however, it was necessary to provide protection against workmen walking over the struts and against falling objects. It should also be pointed out that the strain gage holes in this case were not located on the neutral surface of the beam for bending in a vertical plane but were above the neutral surface an amount equal to half the thickness of the web. This introduced an

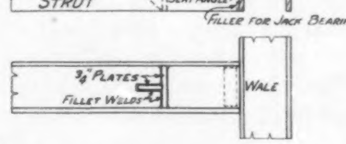

Fig. 8.—Jacking Bracket for Steel Strut.

error due to the bending of the strut under its own weight. In several instances, struts upon which the initial readings had been made were placed in the cut upside down and were later placed in the opposite position. Readings under no load obtained on the struts in these two positions afforded a measure of the combined error caused by operation of the strain gage in an inverted position, and by the effect of the bending. The maximum error associated with these readings was found to be approximately 20,000 lb. in struts whose total load was approximately equal to 200,000 lb.

Probably the largest errors entering the determination of the strut loads by means of a strain gage were encountered because of temperature differences. In particular it was found to be impossible to get satisfactory results if the sun had access to certain parts of the strut and not to others. As a result it was found advisable wherever possible to perform the experiments either while the sun was not shining or under the protection of a tarpaulin.

Initial readings were made while the struts were in position in the cut but before any wedges were driven to cause them to take load. Subsequent readings were made at various construction stages. On two occasions it was possible to obtain the load in a strut both by the use of the strain gage and the hydraulic jacks. On the first occasion, load determined by the strain gage was equal to 63,900 lb. and by the jacking procedure 60,100 lb. In the other case the load determined by strain gage was 150,000 lb., and that by the jacking process 137,000 lb. Experience obtained from the measurement of loads in approximately 150 struts has led to the conclusion that the error is seldom apt to be in excess of 10 per cent of the strut load unless the strut load is less than 50,000 lb. In that case the error may be as great as 10,000 lb. per strut.

Movements Associated with Open Cut Construction:

Of great theoretical importance is the movement of the soil surrounding an excavation during the process. It was pointed out by Terzaghi in 1930 that the position of center of pressure above the bottom of the cut should be dependent upon the manner in which the sides of the excavation yielded. From a practical point of view, the yielding of the sides and the rise of the bottom of an excavation are inevitably accompanied by a subsidence of the adjacent ground surface, with possible damage to structures located in the vicinity. As a result, it is important to attempt to find out which mining operations are most responsible for the yielding, in order that measures may be taken to reduce the settlement.

On the excavations for the Chicago subway, steel sheet

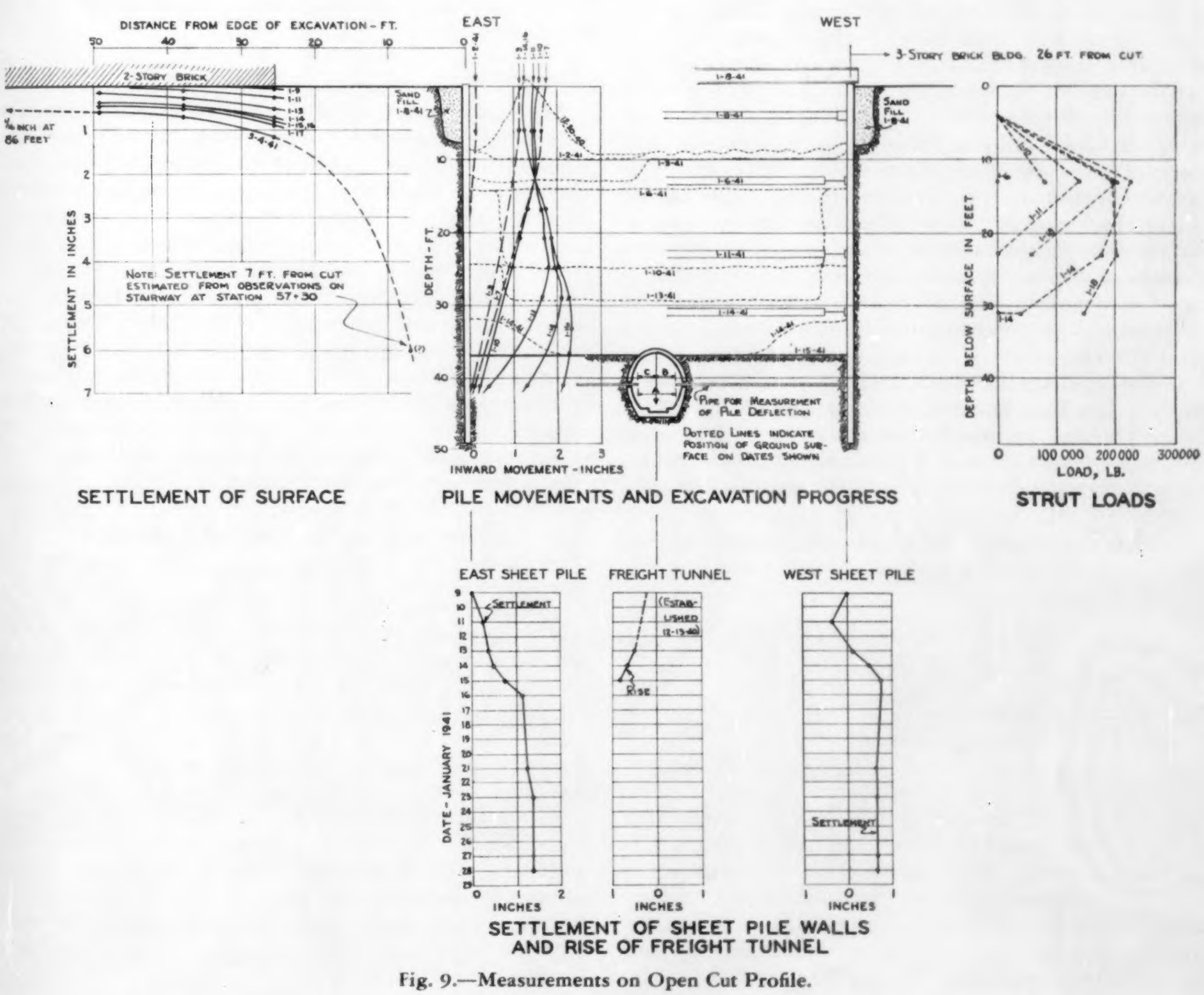

Fig. 9.—Measurements on Open Cut Profile.

piles or H-piles were driven around the outlines of the proposed structures before any material was removed. In either case, the horizontal distance across the cut between the tops of the piles was established before excavation began, and was measured at frequent intervals during the mining process. As excavation proceeded downward alongside a pile, observation points were established on the face of the pile as soon as possible, generally immediately after the pile face was exposed. A plumb line was dropped from the reference point established at the top of the pile and offsets measured to the observation points. The offsets to the various observation points reflected in their changes the minimum movements experienced by the pile. The method did not provide a completely accurate means for determining the total movement of the piling because any movement which might have been experienced before the excavation had exposed a portion of the pile was not recorded even when an observation point was immediately established.

On one occasion, however, it was possible to make a complete observation eliminating this unknown factor. A small tunnel existed below the bottom of one of the open cuts as shown in Fig. 9. The sheeting extended 12 ft. below the bottom of the cut. A small hole was broken on each side of the existing tunnel and steel pipes were driven in sections toward each side of the cut until they encountered the sheeting and were firmly seated upon it. Observations were then made of the movements of the ends of these two pipes. When the cut was completed and the final inward movement of the sheet piling at the bottom had been determined by means of the pipes, all of the observation points on the piling were simultaneously observed so that the exact position of the piles in space was known throughout their height. It was then possible to work backward by means of the deflection observations and to establish the position of the piles at all previous stages of excavation. At the same time it was possible to get a measure of the rise of the bottom of the excavation by means of level points located in the small existing tunnel. The results of all of these observations, together with the measured strut loads at the section, are shown in Fig. 9. This figure may be considered as an example of the results obtained by the field measurements described in this paper. They show at a glance that the distribution of earth pressure was not hydrostatic and that the sides of the excavation moved in for a considerable distance even before they were reached by the excavation. It is of interest to note that the type of deformation experienced by the sides of the cut was precisely that which theory indicates is necessary for a nonhydrostatic pressure distribution.

Conclusion

This paper has been presented in the hope that contractors and engineers will be led to make similar observations. It should be noted that the measurements of the minimum movement experienced by the excavation are made with simple equipment found on every construction job, namely, a plumb line, a steel tape, and a 6-ft. rule. Hydraulic jacks are usually possessed by all contractors and a small investment would furnish enough strut shoes to provide significant measurements on any one open cut, after which the shoes could be salvaged and used an indefinite number of times. The use of the 10-in. strain gage is not quite so simple, but any careful engineering graduate associated with the job, with the help of a laborer, can get satisfactory and important information in a small amount of time. This type of information, coupled with an accurate description of the soil properties and the method of excavation, would form an invaluable record of actual case histories which would go a long way toward removing the uncertainty associated with earth pressure problems.

Acknowledgment:

The earth pressure measurements on the Chicago Subway Project were carried out by the City of Chicago Department of Subways and Superhighways. Philip Harrington is Commissioner and Ralph H. Burke was Chief Engineer throughout the major construction program. Charles E. DeLeuw is acting Chief Engineer, and Raymond S. Knapp is in administrative charge of the Survey Section, including Soil Testing. Karl Terzaghi is consultant in matters pertaining to soil mechanics. The author is in direct charge of the Soil Mechanics Program, including the measurements described above. Acknowledgment is made of the cooperation of the contractors engaged on the various contracts, and of the assistance of the firm of Spencer, White & Prentis in the loan of certain hydraulic jacking equipment.

An Engineers' Manual of Statistical Methods

Recently published by John Wiley & Sons, Inc., New York, is Major L. E. Simon's "Engineers' Manual of Statistical Methods." Major Simon is in the Ordnance Department of the U. S. Army, and is Assistant Director, The Ballistic Research Laboratory. While a detailed review of the manual is being prepared for later publication by an A.S.T.M. member who is active in this field, it was felt desirable to announce the availability of the manual. Subjects covered by certain chapters in the book include: Process inspection by variables; a method of expressing quality; and sample size. An appendix discusses specifications and standards of quality. Copies of this 240-page publication can be obtained from the publishers, 440 Fourth Ave., at $2.75 each.

Directory of Industrial Research Laboratories

The National Research Council has recently issued the Seventh Edition of its Directory of Industrial Research Laboratories of the United States. This 372-page book, the result of extensive work, gives for over 2200 industrial concerns maintaining one or more research laboratories such information as names of research directors, classification and number of members on the staff, and an idea of the research activities and publications which may be sponsored by the various organizations covered. A number of indices provide information on geographical distribution, list of personnel and subjects covered by research activities.

Copies of this very valuable publication can be obtained from the Council at its address, 2101 Constitution Ave., Washington, D. C., at $3.50 each.

Review of the Literature of 1939 on the Testing of Materials by Radiographic Methods

Compiled by Subcommittee IV on Correlated Abstracts of A.S.T.M. Committee E-7 on Radiographic Testing

EDITOR'S NOTE.—This correlated abstract and list of references is one of the accomplishments of Committee E-7 on Radiographic Testing. W. P. Davey, Research Professor of Physics and Chemistry, School of Chemistry and Physics, The Pennsylvania State College, is chairman of the subcommittee directly responsible for the preparation of the abstract, the other members of the subcommittee being Victor Hicks, J. P. Magos, E. W. Page, and H. E. Seemann.

REVIEWS

PROBABLY BECAUSE of the war in Europe, the literature on testing by radiographic methods has declined in volume from that of 1938. Instead of two books and five reviews as in 1938, we find one manual (*1*)[1] and three reviews in 1939. One review by Lester, Sanford, and Mochel (*2*) covers radiographic testing (along with other methods of nondestructive testing) in the United States, one by de Graaf (*3*) covers the work done in Europe, and a third by Pullin (*4*) is a general review.

HARD X-RAYS

Two papers appeared during the year on apparatus for producing hard X-rays and two on the measurement of their intensity and penetrating power.

Charlton, Westendorp, Dempster, and Hotaling (*5*) describe a million volt X-ray outfit consisting of a low-frequency resonance transformer with a coaxially mounted multi-section X-ray tube within. The insulation for both transformer and X-ray tube is compressed dichloro, difluoro methane. The breakdown strength of this material is discussed. Methods are given for measuring the tube current and tube voltage, wave form, power input, and power output. The cooling of the transformer is discussed.

Trump and Van de Graaf (*6*) describe a small sized (34 in. diameter by 100 in. height) electrostatic generator with an air pressure of 11 atmospheres (absolute) which gives 1250 kv. at one milliampere. With Freon gas, only one-third of this pressure is needed for the same voltage and current. They find that at 1250 kv. the X-ray intensity per milliampere in the direction of the electron beam is about 340 rpm. at a distance of 50 cm. from the target with a filter equivalent to 5 mm. of lead.

Van Atta and Northrup (*7*), working in the 800 to 2000-kv. range, show curves for X-ray intensity and absorption at various angles. At 2000 kv. the radiation was three times as intense, and four times as penetrating (deuteron research), as at 1000 kv.

Lester (*8*) has discussed some aspects of radiographic sensitivity in which penetrometers receive considerable attention.

SOFT X-RAYS

Dersham (*9*) has studied the radiography of materials of low atomic weight, using the *K* radiation from scandium. Since this radiation is strongly absorbed by calcium, he suggests that it might be used in investigations of microtome sections of bone.

[1] The numbers in parentheses refer to the papers listed in the References appended to this report.

X-RAY PHOTOGRAPHIC MATERIALS AND SCREENS

Lu, Chang, and Lu (*10*) report that although pressure reduces the sensitivity of Kodak and of Agfa films, it tends to increase the sensitivity of Ilford films. This should probably be checked before giving it too much credence.

Burger and von Dijk (*11*) have studied the smallest particle size that can be distinguished by means of a fluorescent screen. They developed a "Pertinax" phantom with special emphasis on features permitting accuracy. As might have been expected from a consideration of the energy reaching the fluorescent screen, the visibility was increased by going from 50 kv. to 70 kv. These authors found no advantage in using a Lysholm grid at 70 kv.

A new developer has been announced (*12*) which cuts the developing time at 65 F. from 5 min. to $3\,{}^1/_2$ min. with no loss of contrast. It increases contrast with 5 min. development at 65 F. for negatives having only three-fourths normal exposure. A new safe-light filter (*13*) increases dark-room illumination about tenfold so that labels and thermometers can be read easily.

SCATTERED X-RAYS

Pullin (*4*) and Seemann (*14*) have discussed the importance of secondary radiation in producing fog and in lessening contrast and detail in radiographs. Nearly half of the secondary radiation can be removed by the use of lead foil screens in contact with the photographic films.

Brandenberger (*15*) has published pictures which show the effects due to (*a*) primary, and (*b*) scattered radiation when X-rays pass at other than normal incidence through a plate with a slit in it. The difference between the two images is discussed in its relation to the interpretation of X-ray photographs, especially in such cases as faults in welded joints.

Thordarson (*16*) has measured the distribution of secondary X-rays from a special tube over an angular range of from 0 to 90 deg. He used thin foils of aluminum and tungsten as anticathodes, and used filters of copper and aluminum. For strongly filtered rays the angle for maximum scattered intensity agreed with theory in the region 60 to 110 kv. Between 110 and 170 kv. the intensity was less than predicted by theory.

RADIOGRAPHIC TECHNIQUE

Moriarty (*17*) proposes that, in the radiography of irregular objects, fine metallic shot (about 0.010 in. in diameter) be used instead of the customary high density liquid. The shot flows easily and fills in surface irregularities and irregular boundaries. Steel blast shot is recommended for use in radiographing steel objects, but copper

shot is claimed to be better when fast intensifying screens are used.

Under date of December, 1939, the Westinghouse X-ray Co. has issued a folder, the last two pages of which show two graphs (*18*) of exposure data for steel of thickness ranging from $1/2$ in. to $3\,1/2$ in., using 20 and 25 ma. at a film distance of 36 in., and voltages of from 100 to 220 kv. These graphs assume the use of Patterson screens. Within the usual limits of precision for exposure data (about 25 per cent), these graphs agree with those of Isenburger (*19*).

Isenburger's charts make possible a solution of exposure time for steel under various conditions by means of certain calculations followed by the superposition of charts.

Protection

Protection from X-rays and gamma rays is discussed in two handbooks issued by the National Bureau of Standards (*20*), and in the A.S.T.M. Bulletin (*21*) by Taylor. The basic rules for protection, formulated by the International Commission on X-ray and Radium Protection,[2] have been discussed from the economic point of view by Taylor (*22*). He gives curves, tabulates comparative values of lead and concrete, and gives estimated costs for installations ranging from 100 to 1000 kv.

Singer, Taylor, and Charlton (*23*) find that the lead equivalent of any concrete is an increasing function of its mass per unit area and is independent of the nature of the mix. They give relations between lead equivalence, density, mass, and thickness. From these relations the thickness of concrete can be calculated for adequate protection between 200 and 400 kv.

Protection against radium has been studied by Quimby (*24*). He finds that the most efficient protective factor is distance, but that lead is often necessary besides. He gives comparative figures for iron, barium, plaster, concrete, and brick. He stresses the danger from scattered radiation.

Nomenclature

Newell (*25*) compares the problem of radiology with that of illuminating engineering and proposes terms and units for concepts not generally considered in X-ray work, such as Roentgen flux, Roentgen flux density, intensity of an X-ray source, and brightness of an X-ray source. He discussed the advantages inherent in his proposal.

McKeehan has proposed a system of X-ray nomenclature which is sound from the standpoint of physics and which does not deviate too far from the nomenclature proposed by the medical profession. McKeehan's system has been adopted by the American Society for Metals and is included in their Handbook (*26*).

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Meeting Scheduled in Southern California

A note from the Southern California District Committee indicates that tentative arrangements have been made for a meeting on Tuesday, October 28, of the members in Los Angeles and environs to which interested engineers and technologists will be invited. It is planned that the meeting will be in the nature of a forum for discussion of specifications. Further details of the meeting will be furnished each A.S.T.M. member and committee member in the district.

Method for Testing Odor-Taste Contamination Tendencies of Phenolic Plastic Closures*

By A. Herman[1]

PHENOLIC PLASTIC closures have come into widespread use for closing liquor and other beverage containers. While many advantages are apparent, closures made from phenolic plastic sometimes tend to produce foreign odors and tastes around the necks of containers, and, in some cases, contaminate the main body of the liquor.

Temporarily, the following method to test phenolic plastic closures before use was adopted: A definite number of closures were immersed in a definite amount of whiskey or gin, depending upon the proposed use of the closures, for a standard length of time at constant temperature. The liquor was then removed and the taste of the samples compared with the taste of untreated liquor under conditions eliminating all other variables such as temperature, light, alcohol concentration, and personal prejudices or taste-fatigue of the observer.

While a method of this sort is practical in that it tests the material directly for the effect under question, it could not be used as a specification to be presented to a manufacturer of closures. In addition to this, the test consumes too much time. A fast, accurate, chemical test which would evaluate closures in approximately the same order as the taste test was needed.

Closures are made of phenol-formaldehyde plastic, dyes and pigments, and wood flour filler. In two-stage resins, hexamethylenetetramine is used in order that the caps may be properly molded. This sometimes results in loosely combined ammonia being left in the cap. The most important contaminant is free phenol and the cresols associated with it. The chemical test devised was centered around the phenol test and the test for presence or absence of ammonia, the other possible contaminants being only of secondary importance.

Several tests are known for quantitatively measuring phenol, falling into two classes: Bromination methods and colorimetric methods. In preliminary tests for a bromination method, four caps were extracted with 100 ml. of 100 proof ethyl alcohol at room temperature for one week. An aliquot of the liquor was then taken, the phenol fixed with sodium hydroxide, and the solution evaporated to dryness. The sodium phenolate was taken up in water, brominated with a standard bromide-bromate solution, and the excess bromine determined with potassium iodide and sodium thiosulfate. The method was not satisfactory because it took too long and the evaporation to remove the ethyl alcohol was accompanied by a loss of phenol.

The colorimetric methods depend upon the reduction of phospho-molybdic or phospho-tungstic salts by phenol in alkaline solution. The blue color developed is compared with that similarly produced in standards containing known amounts of phenol. For these tests, four caps were immersed in 100 ml. of 100 proof alcohol at 45 C. for 16 hr. An aliquot was treated with the reagent and compared with the standards.

A series of tests was run using various methods of extraction. The extracts from these were analyzed by the bromination and colorimetric methods.

The results of these tests can be summarized:

1. When water is used for extracting phenol, the bromination method is superior to the colorimetric methods.
2. The colorimetric methods have three bad defects: (*a*) Interference colors are formed in extracts made at high temperatures; (*b*) the range of accuracy is limited, being confined to small amounts of phenol, and (*c*) it is necessary to employ the bromination method in order to make up accurate phenol standards.
3. Hot water at 75 C. will extract as much or more phenol than 100 proof alcohol at 38 C.
4. Phenol is lost in the evaporation of alkaline sodium hydroxide solution, thus indicating that a procedure which entirely eliminates ethyl alcohol is desirable.

On the basis of these various tests, it was decided that the bromination test was the most practical. It was also found advisable to remove the liners from the caps before testing, because the tannic acid from the cork interferes slightly with the test. A test for mold or glue odor was set up separately to check the quality of liners.

Test Procedure

Four short-skirt caps (see Fig. 1) with liners removed are placed in a chemically resistant glass-stoppered bottle and covered with 100 ml. of distilled water at 75 C. In the case of the long-skirt type, four caps with liners removed are placed in a glass-stoppered bottle and covered with 200 ml. of distilled water at 75 C. A strip of moist red litmus paper is suspended from the inside of the ground glass joint so that it is in contact with the vapor from the liquid.

The prepared sample is placed in a water bath or oven at 75 ± 1 C., and maintained at that temperature for exactly 4 hr. The preparation is swirled occasionally to mix the solution and to dislodge air bubbles from the caps. At the same time it is noted whether or not the strip of litmus paper turns blue. A change in the color of the litmus paper indicates the presence of ammonia.

The sample is cooled to room temperature in one-half hour, shaken thoroughly, and 25 ml. of the solution pipetted into an iodine flask. Twenty-five milliliters of distilled water is placed in a similar flask for a blank. To each container 10.0 ml. of 0.1 *N* $KBr-KBrO_3$ solution and then 3 ml. of HCl (1:1) are added and the bottles are stoppered quickly. The blank must be run in the same way and at nearly the same time as the unknown samples as is possible.

If a heavy white precipitate of bromophenol appears upon addition of the HCl, it indicates that the phenol

* Presented at the Forty-fourth Annual Meeting, Am. Soc. Testing Mats., Chicago, Ill., June 23 to 27, 1941.

[1] Assistant to Vice-President, Joseph E. Seagram and Sons, Inc., Louisville, Ky.

content is high. Should the bromine color disappear entirely, it is necessary to add 10.0 ml. of additional bromate solution. The samples are allowed to stand for 10 min. and then 5 ml. of freshly prepared KI solution (10 per cent) is added carefully. No bromine must escape. The KI solution is placed around the stopper in the funnel neck of the iodine flask, the stopper is raised slowly, the KI is washed into the flask, and the stopper is replaced. In case no iodine flasks are available, the following alternative method has been found to give satisfactory results: The bromination is carried out in a 100- to 250-ml. glass-stoppered container. Before adding the KI solution, the glass stopper and neck of the container are washed down as the stopper is removed, and a funnel is quickly inserted into the neck. The KI solution is added quickly, both the inside and outside of the funnel stem are washed down immediately, and the stopper is replaced.

The iodine which has been released by the bromine is titrated with 0.1 *N* sodium thiosulfate. When only a faint brown color persists, about 1 ml. of starch solution (1 per cent) is added, and the titration is continued until the blue color disappears.

Calculation of the Phenol per Standard Surface:

$$W = (A - B)\,N \times 31.34$$

Where:

W = milligrams of phenol per standard surface,
A = milliliters of sodium thiosulfate required to titrate blank,
B = milliliters of sodium thiosulfate required to titrate solution, and
N = normality of sodium thiosulfate.

NOTE.—A standard cap surface is defined as the surface of one long skirt cap. A short skirt cap has one half of a standard surface, and a miniature cap has one fourth of a standard surface.

Solutions:

Standard 0.1 N Bromate.—Dissolve 2.784 g. of $KBrO_3$ and 10 g. of KBr in distilled water and dilute to 1 liter.

Standard 0.1 N Thiosulfate.—Dissolve 25 g. of $Na_2S_2O_3 \cdot 5H_2O$ in previously boiled distilled water and dilute to 1 liter.

Standardize against 0.1 *N* $KBrO_3$ solution.

Hydrochloric Acid (1:1).—Mix equal portions of HCl (sp. gr. 1.19) and distilled water.

Potassium Iodide (10 per cent).—Dissolve 10 g. of KI in 100 ml. of previously boiled distilled water.

Starch Indicator.—Dissolve 1 g. of soluble starch in 100 ml. of boiling water.

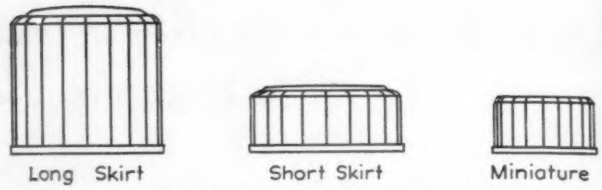

Fig. 1.—Various Sizes of Plastic Closures.

Duplicate determinations on separate sample preparations should check within 0.5 mg. of phenol per standard surface.

Loss of bromine is a common source of error in the determination. A blank run in exactly the same manner as the unknowns will help to minimize this error. Free phenol can be easily washed off the surface of the caps with water, and care should be taken to see that the only water which comes in contact with the caps is that used in the test.

ODOR-TASTE TEST

Samples taken from 33 shipments of phenol-formaldehyde plastic closures, as received from the manufacturer, were analyzed for free phenol by the method given, and duplicates were forwarded to our Quality Laboratory[2] with their identities indicated by code numbers only. Here they were studied by the employment of the standard difference-preference procedure. This technique is very delicate and involves color, amount, temperature, and time control. The results accruing from the odor and taste experiments were treated statistically. At the completion of both the chemical and odor-taste studies, the two sets of results were plotted as shown in Fig. 2. It will be noticed that while the phenol results and those from the odor-taste tests are not perfectly covariant, nevertheless, the trend is unmistakable. A calculated correlation reveals that the two sets of results are related to the extent of 0.64 with a probable error of ± 0.09.

On the basis of these results, it was possible to advance chemical specifications for phenol-formaldehyde plastic closures as regards odor-taste contamination tendencies.

[2] The odor-taste tests and correlation calculation were made by our Quality Laboratory, under the direction of E. H. Scofield.

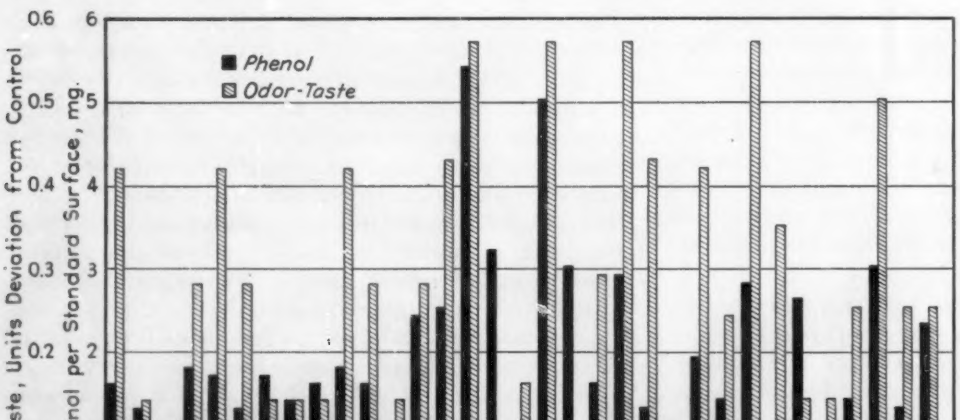

Fig. 2.—Comparison of Chemical and Odor-Taste Tests for Phenolic Plastic Closures.

Fine Aggregate Grading in the 1940 Report of the Joint Committee on Concrete and Reinforced Concrete

By Duff A. Abrams[1]

The 1940 Report of the Joint Committee on Concrete and Reinforced Concrete is the culmination of the work of 10 yr. It is unfortunate that, in the final revision, numerous contradictions and errors were introduced in the sections dealing with fine aggregate grading. Until these contradictions and errors are cleared up, the sections on this subject in both the Recommended Practice and the Standard Specifications will remain inoperative.

Fineness Modulus of Aggregate

Our first contact with fine aggregates in the Report of the Joint Committee is on page 2 where the fineness modulus is defined. This function was derived by the writer about 25 yr. ago, based on studies of concrete[2] conducted at Lewis Institute, Chicago (now part of Illinois Institute of Technology). The fineness modulus has at least 5 distinct uses when applied to aggregates and concrete:

1. As a measure of size and grading of fine, coarse, or combined aggregate.
2. As an index to the optimum percentages in which fine and coarse aggregates may be combined in a concrete mix of given cement content.
3. As an index for use in adjusting the percentages of fine and coarse aggregates of different size and grading in order to maintain essentially equivalent total grading.
4. As a factor in a formula for predetermining the quantity of mixing water required for a concrete mix of given materials and proportions.
5. As an index for measuring changes in size and grading resulting from abrasion or crushing of aggregates.

The Joint Committee restricts its specification usage of this term to the first function and then as applied to limits of grading of fine aggregate only; this seems to be one of the least significant of its many uses.

Examples of the use of the fineness modulus as a factor in a water formula, when applied to recent job mixes, was given by the writer in the *Journal* of the American Concrete Institute, September, 1940, Supplement Part 2, page 400–15.

Definition of the Fineness Modulus

The fineness modulus was defined by the writer as "The sum of the percentages in the sieve analysis of the aggregate divided by 100."[2] The sieve analysis was expressed in terms of percentage by weight coarser than each of the same standard sieves used in the present report.

The Joint Committee has attempted to improve on the foregoing with the following definition:

> "*Fineness Modulus.*—An empirical factor obtained by taking 1/100 of the sum of the percentages of a sample of aggregate retained on each of a specified series of sieves. The sieves used are No. 100, 50, 30, 16, 8, 4, 3/8-in., 3/4-in., 1 1/2-in., and larger, increasing in the ratio of 2 to 1."

The section on Methods of Testing Aggregate (Uniformity of Grading) gives what is in effect another definition:

> "229-S (b) . . . . The fineness modulus of the aggregate shall be determined by adding the total percentages retained on the following U. S. Standard sieves and dividing by 100: 3-in., 1 1/2-in., 3/4-in., 3/8-in., No. 4, No. 8, No. 16, No. 30, No. 50, and No. 100."

The Joint Committee usage starts by giving the fineness modulus a "bad odor" by calling it an "empirical factor"; it then gives two conflicting methods of determining the fineness modulus both of which are confusing and erroneous.

It is interesting to note that the Joint Committee has closely followed the erroneous definition of the fineness modulus which has been used for several years by the U. S. Bureau of Reclamation. Under *Sand* the following definition of fineness modulus is given in the Specifications (No. 570, 1934) for the foundation section of Grand Coulee Dam:

> "The fineness modulus will be determined by dividing by 100 the sum of the percentages retained on Tyler standard sieves, Numbers 4, 8, 14, 28, 48 and 100."

The Tyler series of sieves is essentially the same as the U. S. Standard specified by the Joint Committee; each of the Tyler sieves will conform to all requirements of the like sieve in the U. S. Series.

Fineness Modulus Based on "Coarser-Than" Grading

If a nest of standard sieves is arranged with No. 100 at the bottom, then in ascending order of size, with No. 4 at the top, and a sample of concrete sand is shaken to refusal, a certain percentage of the sample will be "retained on" each sieve. This is the expression used in practically all industries where sieving is done. Yet this is not at all what the Joint Committee means by "retained on" in the official definition. It is impossible to compute the fineness modulus of a sand by taking the sum of the "retained-on" percentages, since every sand would give a sum of almost exactly 100 per cent (for example, see Table II, column 5). It is only by a far-fetched inference that an engineer can guess at what the Joint Committee means by "retained on."

Section 208-S expresses grading in still other terms, "Total Passing, percentage by weight." Those who attempt to use these specifications are left entirely to their own devices, and finally must guess that the values "retained on" (as erroneously used in the definition) must be obtained by taking 100 per cent minus the "Total Passing, percentage by weight." In general one would say that

[1] Consulting Engineer, New York, N. Y.

[2] D. A. Abrams, "Design of Concrete Mixtures," *Bulletin 1*, Structural Materials Research Lab. (1918).

100 per cent — total does not leave very much; but such a formula follows from the Joint Committee usage.

Many different expressions have been used for designating the separate fractions or cumulative fractions of materials in conducting a sieve analysis; the expression of the Joint Committee "Total Passing, percentage by weight" is one that the writer had not heretofore encountered. In this new term the Joint Committee has unfortunately given us a contradiction that may prove extremely troublesome if a contest ever arises over the meanings of the fine aggregate grading clauses in the Standard Specifications.

Section 208-S contains (for example) the requirement that, for the No. 50 sieve, the "Total Passing, percentage by weight" shall be "5–30." It is obvious that neither of these values is the total of anything; in fact, the heading states explicitly that they are percentages. The point is that a quantity cannot be a total and a percentage at the same time; 5 per cent lacks exactly 95 per cent of being total; 30 per cent falls 70 per cent short of being total. The wording of 215-S under grading of coarse aggregate, "Percentage by Weight Passing Laboratory Sieves," is not so objectionable; even here the meaning is uncertain and at any rate the values must be converted to the "coarser-than" basis before we can conveniently compute the fineness modulus.

Section 229-S (b) gives us another puzzle in "total percentages retained on."

The Joint Committee uses the following four methods of indicating sieve analyses:

1. Definition "percentages . . . retained on each."
2. 208-S "Total Passing, per cent by weight."
3. 215-S "Percentage by weight passing laboratory sieves."
4. 229-S (b) "Total percentages retained on."

It is inevitable that endless confusion will result from the above conflicting usages, two of which (2 and 4) are erroneous, and none of which can be fully defended. The Report should be consistent with reference to this usage; the "cumulative fraction coarser than" or the "percentage coarser than," as illustrated in Tables I, III, and IV, is recommended.

The "improved" definitions of the Joint Committee make the fineness modulus practically useless here, and entirely useless if either of the definitions should be quoted elsewhere.

Methods of Computing Fineness Modulus

In order to bring out the true nature of the fineness modulus and to correct the erroneous definitions and methods in the Joint Committee Report, we give 4 different methods of computing this function. This brief excursion into the mathematics of the fineness modulus will show that it is not empirical, but represents a real property of a granular material.

TABLE I.—COMPUTATION OF FINENESS MODULUS, *METHOD 1.*

Sieve	Cumulative Fraction Coarser than Sieve
No. 100	0.99
No. 50	0.92
No. 30	0.63
No. 16	0.42
No. 8	0.20
No. 4	0
Fineness modulus	3.16

TABLE II.—COMPUTATION OF FINENESS MODULUS, *METHOD 2.*

Size Group				Separate Fractions of Sand, f	Fineness Modulus of Fraction, fm
Sieve Size		Mid-diameter, d, in., log scale	Fineness Modulus, m		
min.	max.				
1	*2*	*3*	*4*	*5*	*6*
No. 200	No. 100	0.0041	0	0.01	0
No. 100	No. 50	0.0082	1.00	0.07	0.07
No. 50	No. 30	0.0164	2.00	0.29	0.58
No. 30	No. 16	0.0328	3.00	0.21	0.63
No. 16	No. 8	0.0656	4.00	0.22	0.88
No. 8	No. 4	0.131	5.00	0.20	1.00
No. 4	3/8 in.	0.262	6.00	0	0
3/8 in.	3/4 in.	0.525	7.00	0	0
3/4 in.	1 1/2 in.	1.05	8.00	0	0
1 1/2 in.	3 in.	2.1	9.00	0	0
3 in.	6 in.	4.2	10.00	0	0
Total	....	....	...	1.00	3.16[a]

[a] Fineness modulus of sand.

Method 1.—The simplest and most direct method of computing the fineness modulus of a concrete sand is shown in Table I.

If the cumulative fractions are expressed in percentages, the sum must be divided by 100 in order to secure the fineness modulus. In making a sieve analysis the values for method 1 may be secured almost automatically. After sieving is complete, weigh the material retained on the coarsest sieve; place each smaller size group in turn on the balance, without removing any material from the scale pan, and weigh each cumulative fraction; reduce weights to fractions of the total sample as determined by the final weight. The values may then be entered in the table. The same method is applicable to any granular material.

Method 2.—The fundamental relationships involved in the fineness modulus are brought out more fully in Table II. Here each size group, as measured by the standard sieves, is treated as a single size, represented by the mid-diameter of that group (to log scale). The whole-number values of fineness modulus correspond to the mid-diameters of the size groups; however, like logarithms, there are any number of values between the integral values which correspond to intermediate sizes. The fineness modulus is the summation of the fraction times the fineness modulus of the corresponding group, obtained by multiplying f by m and totaling these products. The resulting fineness modulus of the sand is the same as that given by the more direct method of Table I.

The values for d and m in Table II show that the size of a group is:

$$d = (0.0041)2^m \qquad (1)$$

where d = the mid-diameter of the group (to log scale), and m = fineness modulus (an exponent). The constant 0.0041 is the mid-diameter (to log scale) of the smallest size group (No. 200 to No. 100 sieve) in inches; this is our unit of measure; in metric units this constant is 0.104 mm. or 104 μ. The constant 2 originates, of course, in the use of a set of sieves in which the separation size increases by multiples of 2.

Method 3.—Table II, column 3, shows that the fineness modulus of a 1-in. sphere is a little less than 8. In some instances it is desirable to be able to compute the fineness modulus of a piece of aggregate of a given diameter or of a

size range different from that given by the standard sieves. If we solve for m in Eq. 1, we secure the following general relationship:

$$m = 7.94 + 3.32 \log d \ldots\ldots\ldots\ldots(2)$$

For a 1-in. sphere, $\log d = 0$; hence the second term drops out, and the fineness modulus becomes 7.94, which confirms the approximate value we arrived at from an examination of Table II. This shows how the constant 7.94 is tied to the inch as a unit of length. If the smallest separation size were the same as the unit of length, the constant 7.94 would drop out. If metric units are used, this constant will of course be changed accordingly.

Equation 2 is of general application; however it is not convenient for computing the fineness modulus of granular materials; it gives correct results, but is too laborious, since m must be determined separately for each size group; these values must be multiplied by the corresponding fraction and the products added. Simplified method 1 gives the same result and should be used in dealing with granular materials.

Method 4 (Graphic).—A curve showing the relation between d and m in Table II enables us to read off the fineness modulus of any desired size. There are many other methods, one of which is suggested in the following paragraph.

Sieve Analysis Curves

If we plot standard sieve sizes as abscissae to a log scale (sieves equally spaced) and cumulative percentages coarser than the sieves as ordinates, and draw a smooth curve through the points, we shall have a type of sieve analysis curve which is of particular interest in showing the grading characteristics of an aggregate. If nonstandard square-mesh sieves were used, the fineness modulus may be determined by locating the nonstandard sieves in their proper place on the above chart, plotting the values for these sieves, drawing a smooth curve through the points and reading off and tabulating the percentages for the standard sieves. The fineness modulus is proportional to the area under the curve; it may be obtained by integrating this area. In plotting the curves in this way, we are in fact plotting the fineness modulus of the aggregate as well as the sieve sizes. The area under the curve is made up of the elemental fm rectangles as illustrated in Table II.

The Fineness Modulus Is Not Empirical

The fineness modulus is a real property of a granular material; it is no more empirical than is a table of logarithms, or the area of a circle. Equations 1 and 2 show that it is a function of the logarithm of the diameter of a piece of aggregate, as originally stated by the writer; it is not an empirical factor, as stated by the Joint Committee.

There are dozens of formulas and expressions in the Report that are empirical, but this term has been applied only to the fineness modulus, which is (probably) the only function in the Report that has a rational basis.

The fineness modulus is approximate, due to: (*a*) sampling, sieves, and sieve analyses are all approximate; (*b*) uses only 6 to 9 sieves; (*c*) no separation is made below No. 100 sieve; and (*d*) the units in granular materials are not always of uniform shape. The fineness modulus as determined by method 1 and as illustrated in Tables I, III, and IV is sufficiently precise for the purpose.

Restrictive Limits on Sand Grading

Our second contact with fine aggregates is on page 6 of the Report. Section 206 states with reference to restrictions to be specified on spread of sand percentages on certain sieves:

"However, in no case should a range in grading be specified more restrictive than indicated below:

Passing No. 16 sieve—range 20 per cent or less
Passing No. 50 sieve—range 15 per cent or less
Passing No. 100 sieve—range 5 per cent or less"

The writer confesses his inability to understand these provisions. It seems to begin by stating that the range in percentages of sand passing the No. 16 sieve in Section 208-S must not be limited to 5, 10, or 15 per cent, but must be kept open to 20 per cent; in other words, the engineer should not specify minimum 55 and maximum 65 per cent passing the No. 16 sieve, but should provide limits 20 per cent or more apart (say, minimum 50 and maximum 70 per cent); however, this sensible and proper provision is entirely nullified by the "or less." The "or less" clauses, added since the Progress Report of January, 1937, appear to make nonsense of this entire section of the Recommended Practice.

The definition of the fineness modulus and the "or less" clauses were the only changes made in the sections on fine aggregate grading during the period January, 1937, to June, 1940, while the Progress Report was under consideration; it is an interesting coincidence that all of these changes which resulted from $3^1/_2$ yr. of deliberation should have been erroneous.

Permissible Range in Fineness Modulus of Sand

The aforementioned restrictions on sand gradings are recommended for specification purposes. Restrictions on grading "as delivered" under the Specifications are covered by Section 209-S. It is not clear why the Specifications provide for the rejection of a sand that falls outside the 0.20 variation of fineness modulus from the original sample, or why they imply that penalties may be invoked in "such changes in concrete proportions as may be necessary. . . ." The sand that varies more than 0.20 from the original fineness modulus may be better than the original sample. It is a simple matter to change the sand percentage in the mix to compensate for any reasonable fineness modulus of the sand, if the shipment of sand is essentially uniform.

Grading Limits for Fine Aggregate

Section 208-S requires that fine aggregate shall be graded within the limits shown in the second column of Table III. It is more logical to tabulate with the smallest sieve at the top; the table may then be extended without change to include aggregates up to 6 or 12 in., if necessary.

The Joint Committee missed an excellent opportunity to give an example of the method of computing the fineness modulus of a sand; this could readily have been done by expressing the grading in "percentage coarser than

TABLE III.—JOINT COMMITTEE GRADING LIMITS FOR FINE AGGREGATE.

Sieve Size	Total Passing, per cent by weight	Percentage Coarser than Sieve	
		max.	min.
No. 100	0– 8	100	92
No. 50	5–30	95	70
No. 30*	20*–60*	80*	40*
No. 16	45 –80	55	20
No. 8*	70*–95*	30*	5*
No. 4	95 –100	5	0
$^3/_8$ in.	100	0	0
Fineness modulus	.....	3.65	2.27

* Not given in Joint Committee Report; see text.

sieve" as shown in Table III. The second column of the table gives the limits of sand percentages specified in Section 208-S; the third and fourth columns give the same limits on a "percentage coarser than" basis. In order to compute the fineness modulus it was necessary to supply minimum and maximum values for the No. 30 and No. 8 sieves. This was done by plotting the given values on a chart, then drawing smooth curves through the points, and finally taking off the approximate values for the two missing sieves.

One is struck by the wide range of fine aggregate gradings that is approved by the Joint Committee, as represented by a low value of fineness modulus of 2.27 and a high value of 3.65. The recognition of the feasibility of using sands of a wide range in grading is in exact accord with the recommendations of the writer in 1918,[2] when he introduced a chart for selecting the optimum percentages of sands of widely varying fineness modulus, when the fineness modulus of the sand and of the combined fine and coarse aggregate in the mix are known. The optimum fineness modulus of the mixed aggregate was a function of the quantity of cement used; a lower value was used for "lean" mixes and a higher value for "rich" mixes. Unfortunately, the Committee gave no clew as to what it means by "lean" and "rich" mixes.

In certain quarters during the past 3 or 4 years we have heard lively discussions of the necessity for more fines in concrete sands. Limits such as a minimum of 2 per cent finer than the No. 100 sieve and 10 per cent finer than the No. 50 sieve have been mentioned. It is notable that the Joint Committee failed to recognize the necessity of a more complete treatment of fines in sands than that covered by the usual specification limits.

Interpretation of Tolerance Clause

The clause on tolerance on the fineness modulus of sand has been variously interpreted; the exact interpretation may become of considerable importance as shown by the following example: The specifications for the foundation section of Grand Coulee Dam (4,500,000 cu. yd. of concrete) contract completed early in 1938, contained the following provisions:

"*Concrete Composition*. . . . The individual mixes will be based upon securing concrete having suitable workability, density, impermeability, and required strengths, without the use of an excessive amount of cement, and using, in so far as practicable, the entire yield of suitable materials from the natural deposits from which the concrete aggregates are obtained. If, in the opinion of the contracting officer, it is impracticable to utilize in the concrete the entire pit-run yield of suitable material, the contractor shall be entitled to no additional compensation due to the necessity of wasting any of the excess material."

"The sand for concrete shall have a fineness modulus of not less than 2.50 nor more than 3.00, unless approval is given by the contracting officer to use sand not meeting this requirement."

The above specification seems to imply that sand outside the fineness modulus range of 2.50 to 3.00 might be permitted; however, the engineers for the owners ruled that:

1. Sand should be recombined after separation into 3 sizes by classifiers to a uniform fineness modulus of about 2.65.
2. Sand should be held throughout to 25.8 per cent or 26.9 per cent of total aggregate.

The above rulings resulted in wasting 50 per cent of "the entire yield of suitable materials from the natural deposits." The gradings of sand actually used in the foundation section of Grand Coulee Dam are given in Table IV.

Whether based on a single sample, average of 5 samples on same day or average over 6 months, the sand grading was practically identical throughout this contract. The wasted material consisted of high-quality sand; any desired grading or percentage could have been used. The 28-day strength of concrete was about twice that specified; experiments indicate that workability and permeability would have been improved by increasing the sand ratio.

TABLE IV.—GRADING OF SAND AT GRAND COULEE DAM.

Reference Number[a]	Year	Percentage Coarser than Sieve						Fineness Modulus
		No. 100	No. 50	No. 30	No. 16	No. 8	No. 4	
1	1936	94	76	54	29	13	1	2.67
2	1937	93	75	53	32	13	1	2.67
3	1937	92	74	54	29	13	0	2.62
4	1937	93	75	55	28	12	0	2.63

[a] 1 = Average for first 6 months to June, 1936, from "Special Cements for Mass Concrete," by J. L. Savage; U. S. Bureau of Reclamation, 1936.
2 = September 9, 1937; average of 5 samples same day; U.S.B.R. "Concrete Manual," 1939, p. 124.
3 = October 5, 1937; analysis of single sample, from Sand Inspector.
4 = December, 1937; sieve analysis by Duff A. Abrams on sample of sand from Grand Coulee Dam.

Under the claim that the grading of the sand was not the optimum and that the sand percentages enforced by the Bureau were too restrictive, the contractors are now endeavoring to collect from the Government (on this item alone) the sum of $223,770.[3]

In this litigation it may give the Government considerable advantage to have the erroneous definition of the fineness modulus of the U.S.B.R. given "Joint-Committee status."

Shorthand Signs in Specifications

The form of expression used by the Joint Committee to define limits of fine aggregate grading is highly objectionable. For example (see Section 208-S), what does the expression "5–30" under the heading "Total Passing, per cent by Weight" mean? By eliminating impossible interpretations, and judging from the context, it is found that it probably means (in spite of the column heading) the upper and lower percentage limits on the No. 50 sieve.

The dash used in the expression "5–30" occurs hundreds of times in the Joint Committee Report, with over a dozen different meanings. In fact, it is used dozens of times with no determinable meaning, for example a period followed by a dash. This shorthand symbol should be ruth-

[3] U. S. Court of Claims No. 44,659.

lessly banished from the Report, except for its legitimate engineering use to indicate subtraction or a negative quantity. A specification that is recommended for National use, and that at any time may become the basis of litigation, should not be confused by shorthand signs; nothing should be left to guesswork.

"Cyclopean Particles"

The extraordinary misuse of a word in the Report makes it necessary to discuss rubble and cyclopean aggregates in a paper devoted to fine aggregate grading. The following definition appears under specifications for concrete aggregates:

"Cyclopean aggregate shall consist of clean, hard, durable stone or gravel with individual particles weighing more than 100 lb."

The definition of rubble aggregate is similar, except that it is "retained on a 6-in. square opening and with individual particles weighing not more than 100 lb." So far as we have noted, these are the only usages of "particle" in the Report; the word seems to have been reserved for aggregates larger than 6 in. in diameter.

Apparently the Joint Committee overlooked the significance of the word *particle*. The Latin suffixes *culus*, *cula*, *culum* indicated the diminutive forms of words and invariably had the meaning of *small*, *tiny;* they were carried over to the English with the same significance, as illustrated by: *animalcule*, *canticle*, *corpuscle*, *molecule*, *tuberculous*. In a few English words—*article*, *miracle*, *spectacle*—the suffixes have lost their diminutive force; however *particle* is not in this class; it still means "a very small part."

Murray's Dictionary (England) 1905, defines particle:

"A very minute portion or quantity of matter; the smallest sensible, component part of an aggregation or mass."

Webster's, 1909 and 1935:

"A minute part of matter; a morsel; atom; as a particle of sand."

Standard Dictionary, 1937:

"A minute part, piece or portion of matter, as a particle of dust."

The above definitions indicate: (1) that modern English and American usages are the same, and (2) that the accepted meaning of the word has not been influenced by the "concrete age" which began about 40 yr. ago. Murray's Dictionary traces the usage of this word and shows that it has been used in the English language in the same sense since 1398.

That the definitions quoted represent current usage of *particle* among men of science is demonstrated by the papers presented at a Symposium on New Methods for Particle Size Determinations in the Subsieve Ranges, held at the Washington Spring Meeting of the A.S.T.M., March 4, 1941. Most of the seven papers dealt with fine powders and pigments in the subsieve range; one dealt with the submicroscopic range of sizes. Probably the coarsest material mentioned was portland cement which is ground so fine that 95 per cent, or more, will pass through a No. 200 sieve.

In cyclopean masonry, rocks weighing up to 10 tons or more have been used. The smallest piece of stone or gravel that conforms to the specifications weighs 100 lb., hence we may assume that boulders weighing 700 lb. each would meet their requirements. Such a boulder has a volume equivalent to a sphere 2 ft. in diameter. Pieces of rock which pass through a No. 200 sieve (clear opening 0.0029 in.) may be termed "particles." If a 700-lb. boulder were crushed so that each piece just passes through a No. 200 sieve, it would make 8^{13} pieces, or about 550,000,000,000 "particles."

In the case of a granular material such as concrete sand, which grades into the smallest sizes, there might be some justification for a liberal extension of the meaning of *particle;* however the specification tells us in two different ways ("cyclopean" and "over 100 lb.") that the pieces are not particles. The juxtaposition of *cyclopean* (huge, gigantic, vast) and *particle* in the same sentence and applying to the same thing, should have attracted the Joint Committee's attention. It is unfortunate that the Committee should now inject their "private" and erroneous usage of this word (whose meaning has been fixed and well understood for over 500 yr.) into an engineering nomenclature that is already much confused.

Correction for 1940 Report of Joint Committee on Concrete and Reinforced Concrete

In the above discussion, Mr. Abrams calls attention to an indefiniteness in wording in Section 206 of the Joint Committee Report. We have been advised by the Secretary of the Joint Committee that due to an error in his office in handling the galley proofs, the words "or less" were improperly inserted in this section. The paragraph in question should read:

Passing No. 16 sieve	range 20 per cent
Passing No. 50 sieve	range 15 per cent
Passing No. 100 sieve	range 5 per cent

In any reprinting of the Joint Committee Report, these corrections will be made.

The open mind is the most vital ingredient in meeting an emergency. We can profitably, in normal times, standardize our elements of construction. But we cannot afford, in these days, to freeze our thinking, even for a moment. If we do that, we are beaten.

This does not mean that the great body of established practice that you gentlemen have developed must be thrown out of the window. For that too would be fatal. It simply means that we must now, more than ever, keep the door open for improvement. It means that we must accelerate that part of our thinking and our doing that has to do with the control of the new rather than the control of the old. For this war will be won by something new.

John H. Van Deventer

From his paper on "Mobilizing Materials for Defense" in this Bulletin.

What About Fatigue Failure of Metals?

UNDER THE title "Prevention of the Failure of Metals Under Repeated Stress" a new handbook has been published for the Bureau of Aeronautics, Navy Department, as prepared by Battelle Memorial Institute. The book is issued under the auspices of the National Research Council.

The book grew out of a conference arranged by the National Research Council which included outstanding authorities on the subject of fatigue. It was concluded that engineering principles involved in the precautions through which fatigue failures might be prevented had long been on record, but that much of the important data were scattered and hence relatively inaccessible. The Council then commissioned Battelle Memorial Institute to prepare the compilation. The first draft was by Dr. H. W. Gillett. This was critically reviewed by H. W. Russell and other members of the Battelle staff and also by other technologists concerned with the field.

When we picked up this book on a Sunday evening following a week end of considerable physical exertion which resulted in a type of personal fatigue that gave a rather skeptical attitude toward any dry publication, Fig. 1, showing a fatigue fracture of propeller, was examined with some interest, and also Fig. 2 showing the stamped notches which caused the failure. The next figure or two was examined with more interest and finally we became absorbed in studying in detail each of the 71 figures comprising the portion of the book devoted to the local nature of the fatigue nucleus. Any materials engineer concerned with metals, every machine designer and any mechanic, whether he is a crackerjack or just a nut tightener would be impressed by those figures showing all kinds of failures and explaining the whys and wherefores. Following this startling portion of the book are easily grasped descriptions of endurance strength and various types of tests, stress distribution, and discussions of fillets, notches, keyways, etc.; then in turn reviews of welds, riveted joints, oil holes, questions of corrosion and the like. Reference is made to inclusions, internal stress, embrittlement, severity of notches in hard steels, and discussions of understressing and overstressing and the damage line, consideration of peak stresses due to high duty and to harmonic vibration which it is interesting to note fractured all but one of the crankshafts of the Graf Zeppelin engines on its first flight. Finally, a pertinent three pages on choice of material resistant to crack propagation, concluding with these two paragraphs:

> "The most effective way to prevent failure of metals under repeated stress is to avoid notches. Every time we permit a notch to be present, we throw away one-half to two-thirds of the load-carrying ability we might have if we were more careful in design, in machining, and in inspection.
>
> "Whether it is in the design on the drafting board, whether it comes from a slip in the machine shop, or whether it comes from accidental damage in service and turns up in inspection, a notch should be thought of as carrying a red flag. It means DANGER."

Appendices cover concisely, but efficiently, such subjects as varieties of fatigue-testing methods, effect of speed and temperature on fatigue, questions of stress distribution and concentration, and related factors. Extremely pertinent are the discussion of special materials and the section on welds and riveted joints. There is a glossary of terms used in discussing the mechanical properties of metals and a bibliography of some 450 references.

To repeat, the book should be available in any organization concerned with aircraft, and any company or individual concerned with failure of metals should review it.

It costs \$2.75 (about a penny a page) and can be obtained from the publishers, John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y.

"Zip!!—Die Cast on to Cloth —320 Elements per Minute"

First prize winning photograph in the professional class, Fourth A.S.T.M. Photographic Exhibit, by R. L. Reber, The New Jersey Zinc Co.

The Meter X: A Portable Direct-Reading X-ray Intensity Meter*

By Myron Zucker[1] and L. H. Sampson[1]

This paper describes a portable, rugged, direct-reading X-ray intensity meter that requires little maintenance and may be constructed of inexpensive, commercially available components. For a number of years the X-ray industry has desired such a meter. We believe that the new instrument will be useful in several fields of X-ray and allied work. Arrangements are being made for its manufacture.

We first felt the need of an exposure meter when establishing the technique of radiographic inspection of wood poles. A high percentage of the films was either too light or too dark for diagnosis. This is a common experience, even in routine radiography, but our troubles were aggravated by the great range in absorptivity of the subject (due not only to pole size but to rot and moisture content) and by changes in voltage of the mobile power supply. There were also some unknown variables that necessitated almost monthly revision in the curves based on pole size.

As a result of this experience, in 1939 we tried to find an inexpensive, portable, direct-reading meter, suitable for outdoor use, to make a systematic study of these variables.

Several meters were commercially available, but none met all our requirements. The inexpensive ones were not direct-reading, while those that were or that could be adapted to deenergize automatically the X-ray generator when the film was properly exposed were either too fragile or too expensive. Therefore, we undertook to develop an instrument meeting our requirements.

Meanwhile, others have reported on meters with similar over-all characteristics, but while each is well adapted to its special purpose, none seems to meet all the requirements mentioned. In *Electronics*, April, 1941, a nonportable instrument otherwise similar to ours was described by R. C. Woods and L. P. Kenna. However, because of certain differences in the amplifier a complicated ionization chamber with several inner metal plates was required to obtain relatively high sensitivity. Westinghouse Electric and Manufacturing Co. has recently announced a "Radium Hound" about which we have no technical details. The new Victoreen Minometer, designed primarily for safety-dosage checks, does not give continuous indication of X-ray intensity: the ionization chamber is first exposed to X-rays for a measured length of time and then connected to its electrometer for a reading. It also should be mentioned here that the amplifier which we are using is similar to that described by G. H. Gabus and M. L. Pool in the June, 1937, issue of *The Review of Scientific Instruments*.

The instrument described below seems to have advantages wherever portability and ease of readings are important. Such uses as radiographic exposure determinations, certain types of inspection by scanning, exploration of primary beams and secondary fields, standardization of techniques, and research studies are possible with this instrument.

Since it was apparent that the meter would have a broader experimental use than that for which we originally needed it, we have spent considerable effort in increasing its sensitivity, obtaining a maximum of 0.0007 roentgen per minute, per millimeter deflection on a 50-microampere meter, with a 68-cu. cm. ionization chamber.

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

* Presented at meeting of Committee E-7 on Radiographic Testing, June 23, 1941.

[1] Engineering Division, and Research Dept., respectively, The Detroit Edison Co., Detroit, Mich.

Description of the Instrument

The instrument is shown in Fig. 1. It consists essentially of an ionization chamber, an amplifier of high current sensitivity, and an output meter. An ionization chamber

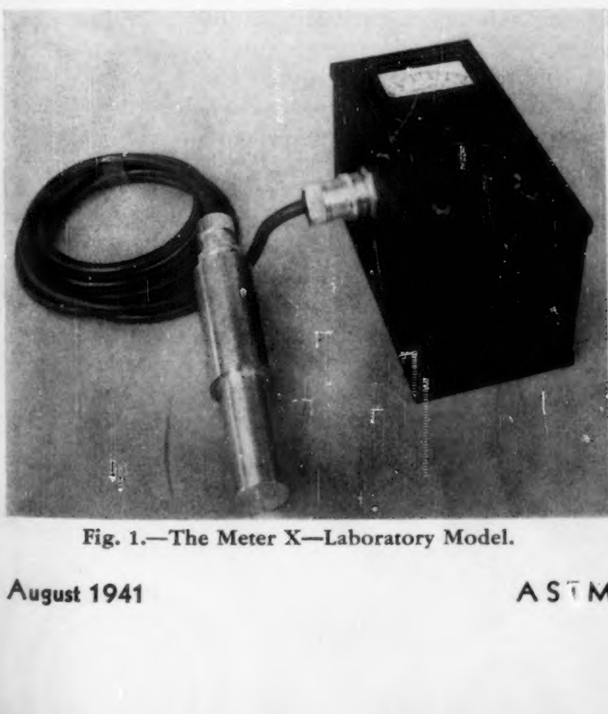

Fig. 1.—The Meter X—Laboratory Model.

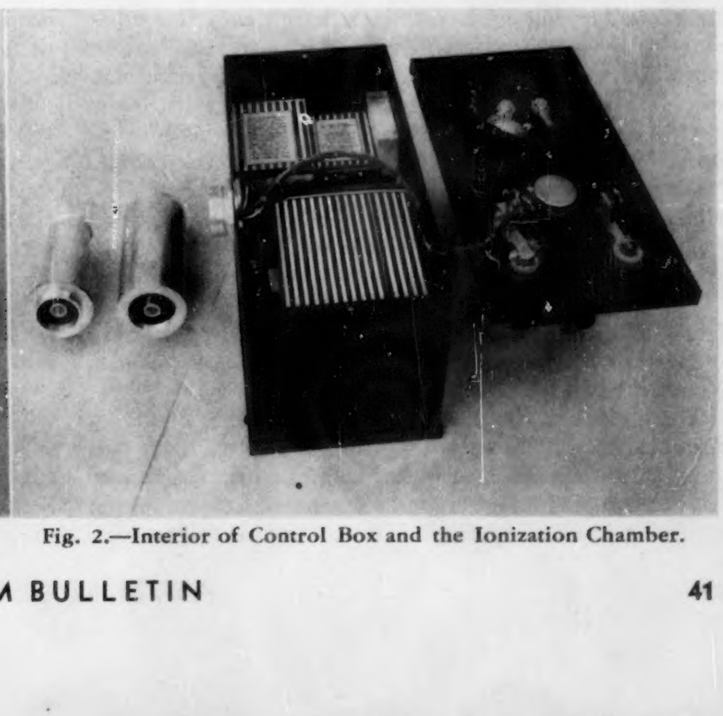

Fig. 2.—Interior of Control Box and the Ionization Chamber.

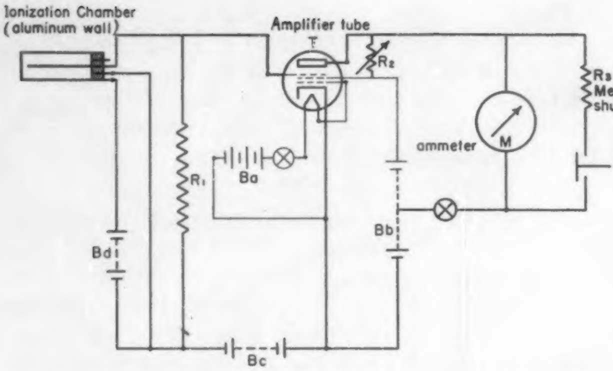

Fig. 3.—Circuit Diagram for X-ray Intensity Meter.

is being used at the present time, but other X-ray-responsive elements have been used. For example, a fluorescent screen and phototube combination was first tried. The ionization chamber is a complete unit in itself and is attached to the housing (containing the amplifier tube and grid resistor) by means of a screw-thread for ease in interchanging ionization chambers of various styles and sizes. The amplifier is connected by means of a shielded cable to the control box upon which the 50-microampere indicator meter is mounted. The box contains batteries sufficient for 50 hr. operation; switches for energizing the battery circuits and for controlling the meter sensitivity, and means for adjusting the zero setting of the meter. Figure 2 shows the interior of the control box and the ionization chamber removed from the amplifier housing.

The circuit diagram is shown in Fig. 3. The grid of the amplifier tube is connected across a resistor which is in series with a battery and ionization chamber. The X-rays penetrate the wall of the chamber, ionize the air inside, and permit a current (approximately proportional to the intensity of the incident X-rays) to flow between the center electrode and the housing. The voltage appearing across the grid resistor as a result of this current flow is applied to the control grid of the amplifier tube. The tube output, which varies with the grid voltage, is measured by the indicating microammeter, which meter may be shunted to reduce the sensitivity if desired. X-ray intensity is read as a scale deflection and reference is made to calibration curves for absolute values. It will be noted by those familiar with amplifier design that instead of standard grid connections for the RCA 954, the elements have been connected according to electrometer tube practice. A few additional details which are essential or highly desirable in the construction include guarding the central electrode of the ionization chamber to prevent leakage currents at the terminal from affecting the indication of the instrument, shielding to eliminate electrostatic pickup, and the minimizing of the stray capacities in the grid circuit to obtain the highest possible speed of response.

The amplifier has been checked for drift, and it was found that with new batteries, the drift is less than 0.1 meter-scale division per hour. Means have been provided for setting the zero by adjusting resistor R_2.

There is some latitude in results obtainable by changing the constants in the tube circuit. For one thing, it was determined experimentally that the amplification can be increased eightfold by increasing the resistance in the control grid circuit from 10^{10} to 10^{11} ohms. However, this sacrifices speed of response; it takes about 10 sec. for the microammeter to reach equilibrium when 10^{11} ohms grid resistance is used. This time delay may, in some cases, be put to good use. For instance, it permits ballistic readings to be taken when high-intensity, short-time X-ray dosages are applied. It is also possible to replace the resistor by a condenser and make an integrating meter that reads total accumulated dosage of X-rays.

Illustrative Uses of Meter

The X-ray intensity meter has been used to study the erratic radiographic results in pole inspection technique. With its use, we have roughly evaluated the relative importance of wood thickness, wetness in sound wood, ambient temperature, wood density, and X-ray tube supply voltage.

The meter has also helped in the problem of protection. Because of our unfamiliarity with X-rays, it was first considered advisable to carry lead screens on the truck, and dispose them so as to intercept all secondary rays to the operator before each radiograph was taken. By exploring the unscreened field around the pole with this new intensity meter (checked at certain points with Ionometer readings and film densities), the accompanying isodose map (Fig. 4) was produced. This showed that for our average conditions of operation there was a sufficient safety factor with respect to the accepted tolerance dose, so that lead screens appear to be unnecessary.

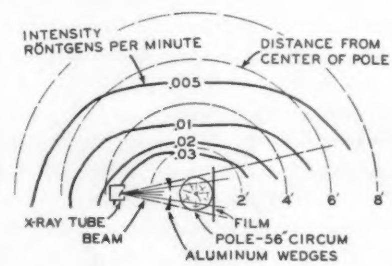

Fig. 4.—Secondary X-radiation, 85 kv.p., 10 ma. Source.

Demonstration

The ease of operating this X-ray intensity meter may be easily demonstrated, as for example noting the variation of intensity as the beam emerges from an aluminum step wedge consisting of eight $^1/_{16}$-in. steps.

It is of interest how this instrument can be used to explore secondary fields about a wood pole. It is readily seen how the field drops off rapidly as the detector is drawn away from the pole at right angles to the axis of the main beam. It would be a long, tedious job to trace such a field by means previously available. Incidentally, it is found that for a given direction, the intensity of secondary X-rays decreases nearly in conformance with the inverse square law. Looking on the side of the pole from which the beam emerges, we see that the secondary values are similar to those found at the side of the pole. But when we lower the collector, we find a sudden increase as we enter the residual primary beam. It is easy to find the edges and rate of spread of this beam by traveling across the border all around the beam and at a few distances from the pole.

DISCUSSION

A Member—How small an ionization chamber can be used and still retain any reasonable sensitivity?

Mr. L. H. Sampson.[1]—I have used a chamber of six or seven cubic centimeters.

A Member.—What do you use for insulation to support the central electrode in the ionization chamber?

Mr. Sampson.—We use styrene, to minimize the leakage current. Since the central electrode is electrically guarded, however, the leakage current would be sufficiently low with any good insulating material.

Mr. D. M. McCutcheon.[2]—What would the sensitivity of the meter be as compared with photographic film? You measure some secondary radiation at considerable distance from the pole: how long does it require to darken a film at these points?

Mr Sampson.—The sensitivity of this instrument is seven ten-thousandths of a roentgen per minute per millimeter deflection. Mr. Zucker has done work with film that may answer your question more directly.

Mr. Myron Zucker.[3]—It takes about 0.05 roentgen to produce measurable darkness on dental film. Therefore an exposure of 35 minutes would be required to darken a film when the meter read 2 divisions. To make the contours of Fig. 4, we took readings at 45-degree angles with respect to the pole axis. To do that work with the meter we simply started about 10 feet from the pole and walked up to it, reading the meter at every foot. We tried to get comparable readings with dental film, to check the meter over as wide a range as possible, but found that even with 20 minutes' exposure, we could not get film darkening beyond 2 or 3 feet away from the pole.

Mr. J. T. Norton.[4]—Is this meter commercially available?

Mr. Sampson.—The instrument we have been using is a laboratory model, and as yet the meter has not been put on the market.[5]

Mr. R. F. Holste.[6]—Have you tried using a point instead of an ionization chamber? There is the possibility of finding flaws in castings by exploring with a needle point, instead of taking radiographs.

Mr. Sampson.—Yes, we have done a little work with needles. It usually has been necessary to place a wire screen around the needle to prevent interference from electrostatic pickup and to restrict the collecting field to a definite small volume.

Mr. Zucker.—We have been interested in this approach. The use of scanning rather than film would not only eliminate film expense but would speed the inspection process.

[1] Research Dept., The Detroit Edison Co., Detroit, Mich.
[2] Metallurgist, Main Laboratory, Ford Motor Co., Detroit, Mich.
[3] Engineering Division, The Detroit Edison Co., Detroit, Mich.
[4] Associate Professor of Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.
[5] Since this discussion there have been so many requests for the meter that arrangements are now being made for its manufacture.
[6] General Electric X-Ray Corp., Chicago, Ill.

Country's Leading Metallurgists Discuss Replacement and Conservation Problems at Philadelphia Meeting

Necessity of Close Cooperation Stressed

At the meeting sponsored by the A.S.T.M. Philadelphia District Committee held in the Franklin Institute Lecture Hall, May 28, over 190 members and guests heard some of the country's leading metallurgists and technical men discuss problems involving the replacement of strategic materials. While the meeting related primarily to metals, other materials including plastics and minerals were referred to.

The meeting was essentially a joint one, the technical program being arranged in cooperation with the National Research Council's Advisory Committee to OPM on Metals and Minerals. Dr. Zay Jeffries of the General Electric Co., Cleveland, Ohio, who is Chairman of the Subcommittee on Metals Conservation and Substitution, was the principal speaker; and Dr. Gilbert Seil of the E. J. Lavino Co., Norristown, Pa., Chairman of the Subcommittee on Ferrous Minerals and Ferroalloys, also gave an interesting address.

Dr. G. E. F. Lundell, then Senior A.S.T.M. Vice-President, now President, and Chief, Chemistry Division, National Bureau of Standards, described a number of phases of the important work being carried on at the Bureau in its study of Federal specifications which involve strategic materials and he commented on the efforts being made to conserve these.

Past-President A. C. Fieldner, Chief, Technologic Branch, U. S. Bureau of Mines, spoke on a number of the activities of the Bureau of Mines in connection with exploration and investigation of various ores and metal deposits and the special methods which have been developed to extract the desired materials. Whether these processes will come into industrial use depends on the success in boosting present production and the cost and other economic considerations.

Others who participated in the program were Major L. S. Fletcher, Frankford Arsenal, Philadelphia; W. M. Peirce, New Jersey Zinc Co., Palmerton, Pa.; Jerome Strauss, Vanadium Corporation of America, New York, N. Y.; F. B. Foley, the Midvale Co., Nicetown, Philadelphia, and A. J. Phillips, American Smelting and Refining Co., Perth Amboy, N. J. It will be noted that a number of these men came from out of town to participate in the meeting. T. S. Carswell, Monsanto Chemical Co., at the specific invitation of F. G. Tatnall, Baldwin-Southwark Corp., and Chairman of the Philadelphia District Committee, who was in charge of arrangements for the meeting, came from Springfield and gave an interesting talk on plastics.

L. E. Ekholm, Metallurgical Engineer, Alan Wood Steel Co., was in charge of the technical program and he

presided, introducing the speakers, and also contributed to the discussion.

This meeting was the second sponsored by the District group on this very important subject, the first having been held late in April. Both meetings were excellent, and the District Committee is to be complimented on its activity in stimulating attendance, giving those present much helpful information and data, and furthering interest in A.S.T.M. in the Philadelphia area.

General Technical Discussion

While a number of the discussions were "off the record" and certain of the data have been superseded by more recent information, some of the comments can be reviewed in general terms.

One speaker indicated that it would seem one of the major services metallurgists can provide would be to compile in understandable form the latest information on metals which may be helpful in replacement, not necessarily limited to such properties as tensile strength, elongation, and yield point but other properties which in some instances are more valuable to designing engineers such as yield strength, impact value, machinability and formability and related items. On the other hand, several others felt that in each case where replacement is necessary the problem must be studied on its individual merit by materials engineers and designing engineers, and that no volume or book of knowledge could suffice. Further, it was stated that frequently the application of materials precedes the development and evaluation of engineering data and that sound judgment of experts in the field may result in much timesaving.

While it may develop that the tin situation will be a critical one, at the moment it is not. Fortunately, of the some 90,000 tons used annually a very considerable percentage is not an essential requirement, and with the new smelter under way in Texas upwards of 20,000 tons would be made available from Bolivian ore imports and with the possibility of using concentrated ore from the East Indies there might possibly be 30,000 tons. It was indicated that with these amounts we could get along without serious difficulties.

On the subject of aluminum a great deal has been spoken and published, much not based on factual knowledge. A speaker cited the testimony of one of the executives of a producing company that the aluminum supply was not a bottleneck with regard to the production of aircraft. While there are ample supplies of bauxite, particularly in the Arkansas region which could be worked, most of the ore has and undoubtedly will continue to come from the Guianas in northern South America. It is much easier to concentrate this imported ore than that from American sources. This trade route can undoubtedly be kept open. There probably could be made available through the cooperation of the housewife an estimated 100,000,000 lb. of pots and pans which doubtless could be gathered in a few weeks, in case of emergency. Some estimates of annual requirements use a figure in the neighborhood of 1,200,000,000 lb., which it was indicated American enterprise would undoubtedly make available in the near future.

The demand for magnesium will undoubtedly keep up with top industrial production. It is constantly finding new applications in defense, particularly in structural uses in aircraft.

In considering what types of materials are to replace certain critical materials, one speaker pointed out that in many instances manufacturers could revert to materials they had been using ten or fifteen years ago before the newer materials came into such widespread use, the use of steel stampings, for instance, for certain non-ferrous die castings, was cited. However, in the case of brasses or bronzes, particularly for military needs, they have been used so extensively for so many years that replacements would be extremely difficult, though possible. Furthermore, this situation is tied inseparably to the hazard of life conditions. The possibility, for instance, of premature explosion of cartridges or shells makes replacement of copper and copper alloys in military applications a very ticklish one.

All zinc producers are working at full speed and new plant facilities will help this situation in the near future, but the speaker who discussed this question pointed out one factor that needs to be kept in mind, that more hours will not help since this is a continuous process. The mining of zinc ore is also an important problem with bottleneck symptoms.

Lead is one metal which was not on priority but in substituting this material for other products weight factors frequently must be considered. Reference was made to the possibility of new lead-bearing alloys one of which was to be described at the annual meeting of the Society with a content of 12.5 per cent antimony, 3 per cent arsenic, 0.75 per cent tin, and the balance lead. That there would be a fairly continuous flow of lead ore into the country seemed certain, since this material along with certain other ores can constitute ballast.

Mr. Ekholm in discussing conservation of nickel used a number of slides showing the physical and chemical properties of alloys which can be used for the higher nickel type steels. These data have been subsequently published by the Iron and Steel Institute. Very considerable savings of nickel can result although this element because of the desirable properties it imparts would need still to be an essential part of many of the compositions.

With respect to corrosion-resistant and heat-resistant castings where a relatively high content of nickel has been the normal practice, here again the nickel, although essential, may be very materially reduced. This would mean a reduction in certain properties but not materially altering the inherent properties of the material.

The speaker who covered the topics of manganese, chromium and related elements indicated that ore deposits were quite extensive and that many of them could be worked if necessary, although the present sources of the material provide a much more economical setup. The present supplies will keep us going for many months but conservation is necessary to extend this period. Consequently the possibility of reducing manganese in certain types of steels may need to be considered. Furthermore, manganese will be used as a replacement for certain other more critical elements and caution is the byword.

As a result of extensive explorations by U. S. Bureau of Mines a new source of tungsten has been discovered in the western states which is workable and should relieve somewhat the worry with respect to this essential element.

More Annual Meeting Scenes (for additional photographs see pp. 6, 9, and 10): Left—A Session of Committee D-5, Past-President A. C. Fieldner, *Chairman,* presiding at the left; Center—Joint Committee on the Effect of Temperature on Properties of Metals (front row, l. to r.), F. B. Foley, J. W. Bolton, and N. L. Mochel, and (lower right, arm over chair), Dr. A. E. White; Right—Officers of the Chicago Committee on Arrangements (l. to r.), J. de N. Macomb, *Vice-Chairman,* H. H. Morgan, *Honorary Chairman,* C. E. Ambelang, *Secretary,* and E. R. Young, *Chairman.*

Grain Size Comparator

By C. H Davis[1]

During the past year it was brought to the attention of the writer that the Euscope manufactured by the Bausch & Lomb Optical Co. was being successfully employed to judge the grain size of specimens of annealed brass sheet.

A 12.5× eyepiece with a 22.7-mm. objective gave a 75× magnification to the image projected on the screen of the Euscope. In order to compare this image with the printed A.S.T.M. grain size standards[2] it was necessary to lift the eyes above the Euscope. It seemed better that the comparison be made within the box where the image of the unknown sample could be viewed immediately adjacent to, and on the same plane as, the standard micrographs. This, however, would only be feasible with standards prepared as transparencies.

It has been the practice in some laboratories for a number of years to have illuminated transparencies beside the ground glass of the metallurgical microscope. A modified apparatus (shown in detail in Fig. 1) has been made and has been successfully used for several weeks. Five or more transparencies are mounted on a white-flashed opal glass plate so that transmitted light is well diffused. The remaining standards may be on a similar plate. The light bulb may be colored to simulate the color of the specimen while the intensity of the light can be regulated by means of a rheostat. The transparencies are made on contrast lantern slide plates and are cut to convenient size so that any three consecutive grain size standards are visible within the dark box for direct comparison with the unknown. The standards are moved readily back and forth in the grooved track.

Although not in a position to undertake immediately the commercial development of the apparatus, the Bausch & Lomb Optical Co. have kindly given approval to the publication of this variation of the Euscope principle.

Acknowledgment:

Acknowledgment is made of the assistance of Mr. G. H. Barney in preparing the drawing and in the development of the comparator.

[1] Assistant Technical Manager, The American Brass Co., Waterbury, Conn.

[2] Tentative Methods of Preparation of Micrographs of Metals and Alloys (E 2 – 39 T), 1939 Book of A.S.T.M. Standards, Part I, p. 1214.

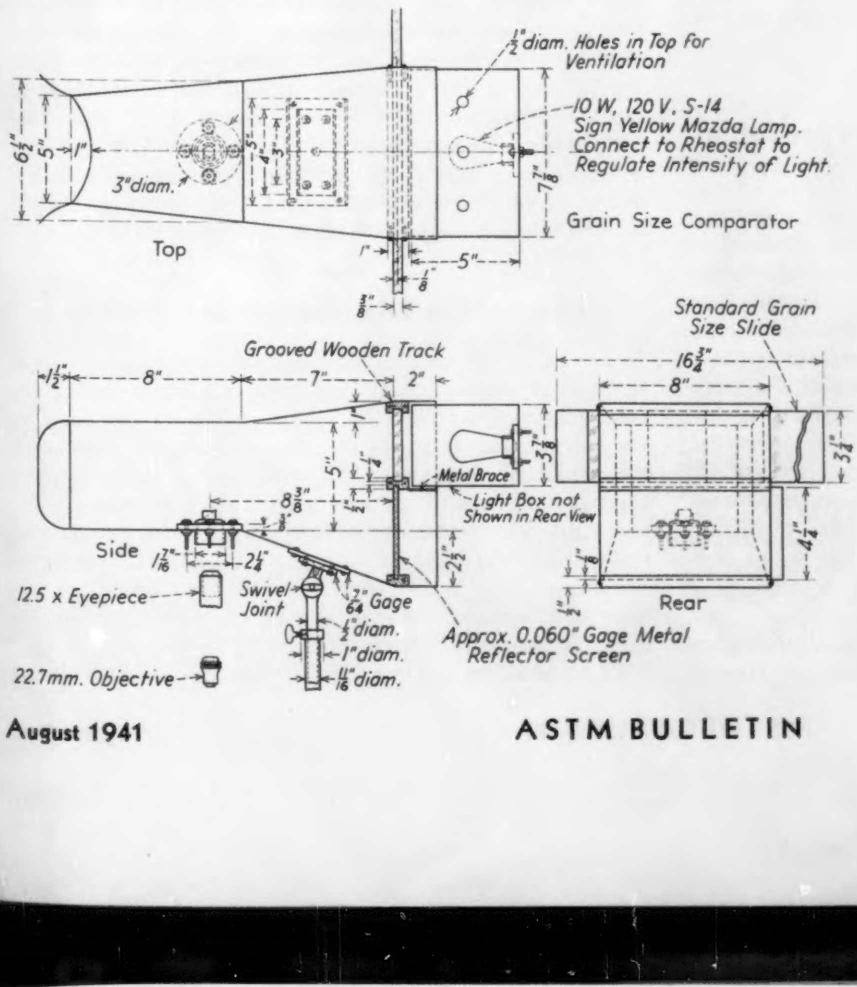

Fig. 1.—Grain Size Comparator.

ASTM Bulletin

AUGUST 1941

NO. 111

TWO-SIXTY
SOUTH BROAD ST.
PHILADELPHIA, PENNA.

PRESIDENT G. E. F. LUNDELL WRITES—

There is something out of the ordinary in a Society that can attract nearly one-third of its membership, many from distant points or pressing duties, to a meeting devoted almost entirely to serious affairs. At the Chicago Meeting these included the astonishing total of some 250 committee meetings, plus 17 half-day technical sessions in which there were presented 4 addresses, 62 committee reports and 65 contributed papers dealing with materials and methods of test. Numbered by the thousands were the informal meetings and conferences in which friendships were begun or renewed, experiences as well as stories were exchanged, and many a member gained a new perspective and fresh inspiration.

The American Society for Testing Materials is also outstanding in the number of its members who actively participate in its work. For many of the members this effort is "extra-curricular," and calls for the expenditure of time, thought, and energy beyond the regular day's effort. As a result, there is a natural tendency to break training after the immediate goal has been reached, usually at the June meeting, and to let up during the next quarter.

In these critical times the Society cannot sit idly by and rest on laurels won under conditions that no longer obtain. In view of the emergency, each committee might well cut short its time-honored breathing spell, and make a strong effort to get its work well under way before October 1.

G. E. F. Lundell

President

Cooperating

In this Bulletin are three articles dealing with National Defense activities: one, strictly news, on the emergency alternate Federal specifications; second, an announcement of a procedure under which our standing committees can virtually overnight effect temporary revision of A.S.T.M. specifications covering strategic materials; and third, a statement on A.S.T.M. National Defense Activities. The latter is not a complete record of committee activities that are directly related to defense, for there are many other examples of standardization and research work that might be cited as tying in with our present national efforts.

But to mention all of the activities that have a bearing on National Defense would mean reviewing practically all of our committee work, for our entire activities are closely interwoven with our economic structure. Never before has there been such a premium on standardization and investigational work such as we carry on.

The Society committees are keenly alive to their responsibilities and the Society officers have and will take steps to insure that the work of this 40-year-old organization shall align itself closely with any new needs as they become apparent.

An Outstanding Meeting in an Industrial Center

The account of the recent annual meeting appearing elsewhere in this Bulletin leaves no doubt of its outstanding nature. In attendance it was the largest yet held, our committee work reached a peak with more committee meetings than heretofore, the technical sessions were better attended; but what is particularly noteworthy, was the participation of visitors and the attention that meetings received in the industries of the surrounding area. The business of the Society, of course, comes first, and this can be conducted no matter where the meeting is held, provided a good attendance is assured. But aside from conducting its regular business, the Society must grow if it is to function properly and its work must be brought to the attention of industry if it is to be put to maximum use.

Some of our members will prefer one location, others will prefer another. Some will wish to go to Atlantic City every year, perhaps combining the trip with a week-end's vacation and others will go there only under protest. And the fact remains that many—particularly the younger members—can go only if the meeting is brought to them, which dictates rotating the place of meeting. Our Executive Committee is annually faced with the question of where to hold the meeting. The practice followed of meeting at Atlantic City, but holding at least one meeting in three away from the Atlantic seaboard seems to work out satisfactorily. Some of the Society's most successful meetings have been held at Atlantic City and will continue to be held there, but in the final analysis the interests of the Society require that some meetings should be held in districts where industry is concentrated.

Many New Members in the Society

With the publication of the 1941 Year Book in September, there will be readily available a complete roster of the close to 4500 members of the Society, the largest number in its history. A large percentage of the members who peruse the Bulletin no doubt review the list of new members which appears in each issue. Because interest in the list is especially from a geographic standpoint, it is henceforth to be arranged so that a member in a locality where there is a District Committee can determine readily whether any of the new members are from his general neighborhood.

This practice is not intended to promote rivalry between

the various districts. The officers of the Society have refrained from any membership campaign, or activities smacking of competitive or pressure features, feeling that a steady growth, resulting from the interests of the present members plus the distinct advantages of affiliation with A.S.T.M., would be healthy, though not spectacular.

There are few organizations which offer more to the membership in the form of publications, authoritative information and data—practical things to use—than A.S.T.M. It is suggested that many more members might well review the new members list in each BULLETIN. Undoubtedly, they will come across many names that are familiar, and they may get some ideas to help insure a steady growth of the Society, membership-wise.

Discussion of Annual Meeting Papers

WRITTEN DISCUSSION of the papers and reports presented at the 1941 Annual Meeting in Chicago will be received by the Committee on Papers and Publications until September 2. However, all who plan to submit discussion are urged to send it to Society Headquarters as far in advance of this date as possible in order to facilitate preparation of material for the *Proceedings*. Discussion adds considerably to the value of the technical material published in the *Proceedings* and all those who may have additional material to submit, or wish to offer constructive comments, are urged to do so.

Large Number of Standards Referred to Letter Ballot

BY ACTION OF THE Forty-fourth Annual Meeting, 170 recommendations from standing committees affecting standards and tentative standards were approved for submission to letter ballot of the Society membership. These recommendations comprise 88 tentative standards proposed for adoption as standard and the adoption as standard of 82 revisions in existing standards.

A complete list of the items to be voted upon appears in the letter ballot being sent in a separate mailing to the members. Detailed information concerning all matters referred to letter ballot is given in the committee reports issued in preprint form to the membership in advance of the meeting. The *Summary of Proceedings* accompanying the letter ballot contains a record of all actions taken at the annual meeting and also gives in full detail any changes in or additions to the standing committee recommendations as preprinted.

In addition to the action on standards, amendments to the by-laws are also being referred to letter ballot. These changes, listed in the ballot, were given in detail in the preprinted 1941 annual report of the Executive Committee which also outlined the reasons for the amendments.

The ballot will be canvassed on September 2 at which time all items receiving a favorable vote become effective.

1942 Annual Meeting in Atlantic City; Spring Meeting in Cleveland

AN INVITATION from the Cleveland District Committee of the Society has been accepted to hold the 1942 A.S.T.M. Spring Meeting and Committee Week in Cleveland during the first week in March, Monday through Friday, March 2 to 6.

No decisions have been reached concerning the technical features of the Spring Meeting, but Committee E-6 on Papers and Publications in cooperation with the Cleveland District Committee will select and develop groups of technical papers that are appropriate. A symposium on paint is one possibility. This will be the second Spring Meeting in Cleveland, the first having been held there in 1932. The Cleveland district group is an active one including in its membership Messrs. A. J. Tuscany, *Chairman*, W. W. Rose, *Secretary*, and Arthur W. Carpenter, *Vice-Chairman*.

With the annual meeting held in Chicago this year, it is in line with the informal policy of the Society to return to Atlantic City to hold the 1942 (Forty-fifth) Annual Meeting, during the week of June 22 to 26. There will be no Exhibit of Testing Apparatus and Related Equipment in connection with this meeting since exhibits are held only every two years. Further announcements will be made concerning the technical program and other related matters.

Now 139 Sustaining Members

SINCE THE PUBLICATION of the May BULLETIN three new sustaining members have been added to the list of companies which support the Society through this means. Brief accounts of the activities of these companies in A.S.T.M. are given below. As has been the case in connection with the other organizations which have acquired this type of membership, these two companies have also contributed much to the standardization and research programs of the Society.

Full announcements have previously been made of the advantages of sustaining membership such as the receipt of a copy of *every* publication issued by the Society which includes quite a number ordinarily furnished only on purchase; a complete set of the Book of Standards and an extra set furnished on request; and extra copies of the ASTM BULLETIN which can be procured by sustaining members for distribution to their executives and engineers who are following A.S.T.M. work.

The dues for a sustaining membership are $100 yearly, while other corporate or company members pay $30. Individual membership dues, which include Government departments, universities, libraries, and the like, are $15.

CHASE BRASS AND COPPER CO., INC., D. K. CRAMPTON, RESEARCH DIRECTOR, WATERBURY, CONN.

Affiliated with A.S.T.M. as a company member since 1920, this company through its technical men has been extremely active in numerous phases of Society work. For almost twenty years Doctor Crampton has represented the company on Committee B-2 on Non-Ferrous Metals and Alloys, and for a long period of time has been an active member and officer of other A.S.T.M. groups including B-3 on Corrosion of Non-Ferrous Metals and Alloys; B-5 on Copper and Copper Alloys, Cast and Wrought; and E-4 on Metallography. He also represents his company on the Committee on Spectrographic Analysis and serves as the representative of Committee B-5 on the Sections on Thin Sheet Metals and on Elastic Strength of Materials of Committee E-1. He is one of the

Society's representatives on the (Non-Ferrous) Metallurgical Advisory Committee of the National Bureau of Standards.

H. P. Croft, Chief Metallurgist for the company in Cleveland, has been a personal member since 1929. Both he and L. A. Ward, Assistant Metallurgist, Waterbury, who was formerly a personal member for a number of years, are active in the work of Committee B-5. B. H. McGar and P. A. Leichtle are company representatives in certain committee work, the former serving on Committee E-3 on Chemical Analysis of Metals and Committee B-8 on Electrodeposited Metallic Coatings, and the latter on Committee E-2 on Spectrographic Analysis.

General Electric X-ray Corp., E. W. Page, Manager, Industrial Sale Dept., Chicago, Ill.

As the leading organization in its field, the company has been represented in the Society through a personal membership held in Mr. Page's name, this membership having been transferred to the class of sustaining. For a number of years Mr. Page has been active in the work of Committee E-7 on Radiographic Testing, is chairman of its Subcommittee VI on Safety, serves on the Advisory Committee, and is a member of four other subgroups.

Koppers, Co., Tar and Chemical Division, E. O. Rhodes, Technical Director, Box 7372, Oakland Station, Pittsburgh, Pa.

Since 1921 this membership, which before its consolidation with the Kopper Company was the American Tar Products Co., has been represented in the Society by Mr. Rhodes who has participated actively in many phases of A.S.T.M. work and assisted greatly in sponsoring numerous standardization and research activities. For upwards of 20 years he has been concerned especially with the work of Committees D-4 on Road and Paving Materials and D-8 on Bituminous Waterproofing and Roofing Materials, serving on a large number of subcommittees. For instance at present Group B on Methods of Test of Committee D-4 is under his supervision; he serves as chairman of the Subcommittees on Accelerated Weathering Tests of Bituminous Materials and on Specific Gravity of Bituminous Road Materials. He is on both the D-4 and the D-8 Advisory Committees and on D-8 is Chairman of Subcommittee V on Specifications for Bituminous Coatings for Cold Application. Other committees on which he is active include D-1 on Paint, Varnish, Lacquer, and Related Products and D-18 on Soils for Engineering Purposes where he serves on three subcommittees. He is the representative of Committee D-4 on certain Committee E-1 sections.

Procedure Established for Temporary Modification of A.S.T.M. Standards

The Executive Committee has recognized the desirability of providing for prompt modification of A.S.T.M. standards during the national emergency and that some appropriate method be established in anticipation of necessary changes, particularly in specification requirements, due to possible rapid shifts in the available supply of materials under present conditions.

In the case of certain metals and alloying elements, for instance, scarcity and the need of conservation for defense purposes might point to the need of modifying the usual specified compositions of many alloys containing such critical materials, and of doing so more promptly than the regular procedure would permit. In fact, in most instances it will probably be found preferable not to change the standard itself but to provide for temporary optional requirements. Our regular procedure provides that a standing committee, after approval in its group, can refer to any time proposed tentative revisions of standards, new tentative standards or changes in tentative standards to Committee E-10 on Standards. While in this way reasonably prompt action can be taken with respect to desirable changes leading to formal revisions of a standard, a proposed emergency procedure is now offered our committees which is intended to expedite the approval and publication of emergency revisions of a temporary nature and at the same time provide adequate safeguards in their promulgation.

Revisions promulgated under this procedure are to be construed as representing optional requirements, to be introduced by the following expression: "Where it may be considered by the purchaser a satisfactory revision for the specific application or use desired."

Proposed temporary modifications shall first have the approval of the appropriate subcommittee of the sponsoring committee or duly appointed subgroup of that subcommittee and shall have the endorsement of the chairman of the main committee. The emergency revision shall then be submitted to Committee E-10 for approval for publication with the specification in question. If approved by Committee E-10, it will be published with the specification either in the form of a sticker or as an accompanying sheet and will also be published in the next succeeding issue of the ASTM Bulletin. Any emergency revisions approved during the year will be recorded in the next annual report of the standing committee. All such revisions will be subject to annual review and the standing committee shall annually report its recommendations with respect to them.

This procedure is available for use in the case of emergency revisions initiated by A.S.T.M. committees in the light of the emergencies of the defense program; or for revisions in A.S.T.M. standards resulting from requests of the Government; or to bring A.S.T.M. standards into conformity with similar emergency revisions made in corresponding Government specifications.

The Executive Committee has further arranged that the Society lend its support in publicizing the Emergency Alternate Specifications issued by the Government and bringing them to the attention of the A.S.T.M. standing committees interested. Whenever there is a corresponding A.S.T.M. specification, the standing committee may wish to issue a similar optional emergency alternate A.S.T.M. specification, calling attention to the alternate by a notation on the specification in question. The procedure to be followed by the committee in the development of such alternate specifications will be the same as that indicated above for the approval of emergency revisions.

To recapitulate in the interest of clarity, the steps involved in approving and publishing temporary modifications of an A.S.T.M. standard are listed:

1. Approval by subcommittee or duly appointed subgroup of standing committee.
2. Endorsement by the main committee chairman.
3. Approval by Committee E-10 for publication with the specification.
4. Publication with the specifications as a sticker or accompanying sheet; also in next ASTM Bulletin.

5. Recorded in the next annual report of the standing committee.

6. All such revisions to be reviewed annually and recommendations concerning them incorporated in the report.

Ample opportunity for directing attention to any temporary modifications of standards or optional emergency alternate specifications is available through the regular distribution of the BULLETIN to the members, Circular Letters which are sent during the year, and in other ways. The mechanism will be established for distributing stickers or announcing the changes to nonmember purchasers of the Book of Standards.

Emergency Alternate Federal Specifications

Explanation and List of Important Alternate Requirements

IN THE 1941 ANNUAL REPORT of the Executive Committee, which discusses the relation of A.S.T.M. with the Government in connection with work on engineering materials, there is reference to the promulgation of Federal "emergency alternate" specifications which are being developed through the Federal Specifications Executive Committee in collaboration with the Office of Production Management. The F.S.E.C. work is directed by N. F. Harriman, vice-chairman of the committee and special assistant to the Director of Purchases, OPM; the collaboration of OPM is directed by the Secretary-Treasurer in his capacity as consultant in the Government Conservation Branch, Division of Purchases.

Under the emergency alternate plan, the Federal specification itself is not changed. Each of these specifications which has thus far been a relatively short, concise document with one exception, carries in a preamble the following statement:

"In the interest of conservation of certain strategic materials, this specification was approved on the above date by the Director of Procurement, for the use of all departments and establishments of the Government, and shall become effective immediately as an *Emergency Alternate Specification* in the purchase of the commodity covered by it, where it may be considered a suitable alternate for materials covered by Federal Specifications (respective title and designation inserted)."

From the inception of this procedure, it has been felt by the officers of the Society that if deemed appropriate by the Government authorities a list of the emergency alternate specifications would be furnished to A.S.T.M. members, chiefly through publication in the ASTM BULLETIN. The first of these lists appears below. In reviewing these lists members should keep specifically in mind that the specifications are for use by various Government agencies in their purchasing. There has been no attempt to achieve a wide dissemination of these specifications, although bidders on Government contracts using the specifications may obtain copies through the usual Government channels. However, A.S.T.M. Headquarters is prepared to distribute a limited number of the specifications on request from those interested in the commodities covered. A few copies of the specifications are now available, and if there is sufficient demand the specifications will be duplicated and distributed to members as a service.

In developing emergency alternate specifications, the Federal specification committees have the advice and recommendations of some of the country's leading technologists from among the materials consultants on the OPM staff and from the industries. The work of the Advisory Committee on Metals and Minerals appointed by the National Academy of Sciences is very helpful. The National Bureau of Standards has aided in a survey of all Federal specifications using certain strategic materials and many members of its staff are directly aiding in this specification work. Industry conferences have been held in several instances to develop details of emergency specifications, those on tableware being a notable example.

After the emergency specifications have been officially promulgated, the Director of Purchases, OPM, calls them directly to the attention of the chief purchase officers of all Government departments and agencies and requests their use in all possible instances as a means of conservation of strategic materials for defense.

Members will be interested to note in another article in this BULLETIN the procedure that the Executive Committee has approved for temporary modifications in A.S.T.M. standards. Reference might also be made to another BULLETIN statement outlining some of the current activities of A.S.T.M. groups in making available to Federal agencies essential information dealing with materials, particularly in connection with the conservation of strategic materials and products.

Specification Number	Description
E-OO-L-131b	Laundry Appliances
E-RR-C-81	Cans, Corrugated; Ash and Garbage
E-QQ-S-781	Strapping, Flat, Nailless; Steel, Painted and Zinc-Coated (Galvanized)
E-J-C-71	Cable, Cord and Armored
E-W-B-616	Boxes and Outlet-Fittings, Floor; Conduit and Tubing
E-W-F-406	Fittings, Cable and Conduit
E-W-O-806	Outlet-Bodies; Iron, Cadmium or Zinc-Coated
E-W-O-821a	Outlet-Boxes; Steel, Cadmium or Zinc-Coated
E-W-P-131	Panelboards; with Automatic-Circuit-Breakers
E-W-P-146	Panelboards; with Fuse-Connections or Switches
E-W-R-36	Raceways and Fittings; Metallic, Underfloor
E-W-R-41	Raceways and Fittings; Nonmetallic, Underfloor
E-FF-N-101	Nails; Spikes; Staples and Tacks
E-QQ-C-806	Culverts; Iron or Steel, Zinc-Coated
E-RR-F-191	Fencing; Chain-Link or Welded
E-QQ-B-601	Brass Castings (to Be Brazed)
E-QQ-A-318	Aluminum-Alloy(AL-52)(Aluminum-Magnesium-Chromium) Plates, Sheets and Strips
E-QQ-A-354	Aluminum-Alloy (AL-24) (Aluminum-Magnesium (1.50%)-Manganese); Bars, Rods, Shapes and Wire
E-QQ-B-621	Brass, Commercial and Naval; Castings
E-QQ-B-726a	Bronze, Manganese; Castings
E-QQ-W-311	Wire; Bale-Tie, Single-Loop
E-QQ-W-446	Wire, Steel, Zinc-Coated (for Wire-Bound Boxes)
E-QQ-B-691a	Bronze; Castings
E-RR-T-51A	Tableware; Silver-Plated
E-RR-T-41A	Tableware; Corrosion-Resisting Steel
E-WW-T-806a	Tubing; Electrical, Metallic
E-WW-C-581a	Conduit, Steel, Rigid, Zinc-Coated
E-LLL-L-351A	Linoleum; Battleship
RR-T-56	Tableware; Steel (Chromium, Nickel, Silver, and Tin) Plated

Numerous Publications to Be Issued

List Includes Several Special Items

In addition to the so-called regular publications, including the 1940 Supplements to the Book of Standards, *Proceedings*, Year Book, Index to Standards, etc., there are a number of special volumes to be issued within the next few months.

Brief notes on some of these publications are given below for the information of the members, and a list of all of the publications, with special prices to members and other descriptive information, will be sent in the form of an order blank to each member late in September.

The special compilations of standards issued during the past few years have become of increasing significance and, as indicated below, new editions of these widely used books are to be published.

Regular Publications

1941 Supplements to Book of A.S.T.M. Standards:

In line with the publication policy instituted in 1939, the Supplements to the Book of Standards will be issued in three parts as follows:

Part I. Metals
Part II. Nonmetallic Materials—Constructional
Part III. Nonmetallic Materials—General

These volumes will include the newly adopted and revised standards applicable to the materials indicated in the titles of the individual parts, and will also contain the new and revised tentative standards and tentative revisions of standards. It is expected that the Supplements will be ready for distribution by October 31.

1941 Proceedings:

This year the *Proceedings* will again be issued as one volume, containing both committee reports and technical papers, together with the discussion thereof. They will be mailed about December 31.

Index to Standards and Tentative Standards:

This Index, which continues to increase in value as the number of specifications becomes larger, will again give the latest complete references to publications where the various specifications and test methods appear. The Index is furnished to members, and is also widely distributed, on request. Members may obtain additional copies without charge. To be published about October 31.

Year Book:

Includes a list of the complete membership of the Society (name, address, company, etc.), the personnel of all A.S.T.M. committees, and other pertinent information. Furnished only to members, on request. Publication date—September 15.

Symposiums on Particle Size and Color:

The following symposiums were held at the Washington Spring Meeting, on March 4 and 5, respectively:

Symposium on Particle Size—New Methods for Particle Size Determinations in the Subsieve Range

Symposium on Color—Its Specification and Use in Evaluating the Appearance of Materials

The Color Symposium is now on press and should be available at about the same time that this issue of the Bulletin goes in the mails; the Particle Size Symposium is scheduled for publication about September 15.

Index to Technical Reports and Papers (1936-1940):

This is an extension of the former five-year Index to Proceedings, which will include references to papers published in the ASTM Bulletin and in special publications, as well as those appearing in the *Proceedings*. It is scheduled for publication about October 1.

Special Publications

1941 Marburg Lecture:

The Marburg Lecture on "Natural and Synthetic Rubbers," delivered by Dr. H. L. Fisher at the annual meeting, will be included in the 1941 *Proceedings;* prior to publication in the Proceedings, special reprints of the lecture will be issued—about August 25.

Report on Significance of Tests of Concrete and Concrete Aggregates:

This is a revision of the Report on Significance of Tests of Concrete and Concrete Aggregates originally published in 1935. For the most part, the original chapter headings are being adhered to, although a few additional ones have been included. Publication date, December 1.

Impact Resistance and Tensile Properties of Metals at Subatmospheric Temperatures:

This compilation, prepared by H. W. Gillett, constitutes a report to the Joint Research Committee on Effect of Temperature on the Properties of Metals. It contains a large amount of hitherto unpublished data which had accumulated in various laboratories. About seventy of these contributed data and Doctor Gillett has classified them, has added a large amount of material from the literature, principally foreign, has supplied critical comment, and has appended a comprehensive bibliography. An index to these data is also included.

Special Compilations:

New editions of the special compilations of standards, covering specific industrial fields, will be made available during the latter part of this year. All of the A.S.T.M. standard and tentative specifications and tests in the following fields will be included in the respective volumes: electrical-heating, electrical-resistance and electric-furnace alloys; copper and copper alloys; cement; mineral aggregates; petroleum products and lubricants; electrical insulating materials; rubber products; textile materials; rusting standards for paint; and electrodeposited coatings. The compilations on electrical-heating alloys, copper and copper alloys, and mineral aggregates, are being issued for the first time.

New and Revised Tentative Standards Approved

Withdrawals Listed for Members' Convenience

THE SOCIETY accepted at the annual meeting 75 new tentative standards and revisions of 77 existing tentative specifications and methods of test. Of the new tentative standards 9 are revisions of existing standards—these are indicated in the following list. Fourteen of the 77 revised tentative specifications and test methods represent extensive modifications. The titles of these are included below (marked with an asterisk) with the list of those issued by the Society for the first time. Standing committees responsible for the various items are indicated in italics. The number of new tentative standards is the largest that has ever been approved at an annual meeting with the exception of last year when the number by pure coincidence was the same as for 1941, namely, 75.

New and Revised Tentative Standards

Ferrous Metals

Specifications for Steel (Committee A-1):
Carbon-Steel and Alloy-Steel Blooms, Billets, and Slabs for Forgings (A 248–41 T).
Low-Alloy Structural Steel (A 242 – 41 T).
Carbon-Steel and Alloy-Steel Ring and Disk Forgings (A 243 – 41 T).
Heat-Treated Wrought Steel Wheels (A 244 – 41 T).
Light Gage Structural Quality Flat Hot-Rolled Carbon Steel (0.2499 and 0.1874 to 0.0478 in. in Thickness) (A 245 – 41 T).
Light Gage Structural Quality Flat Rolled Carbon Steel (0.0477 to 0.0225 in. in Thickness) (A 246 – 41 T).
Recommended Practice for:
Evaluating the Microstructure of Graphite in Gray Iron (A 247 – 41 T) *Committee A-3.*

Electrodeposited Coatings

Specifications for Electrodeposited Coatings (Committee B-8):
*Nickel and Chromium on Steel (A 166 – 41 T).
Nickel and Chromium on Copper and Copper-Base Alloys (B 141 – 41 T).
Nickel and Chromium on Zinc and Zinc-Base Alloys(B 142 – 41 T).

Non-Ferrous Metals

Specifications for:
Rope-Lay-Stranded and Bunch-Stranded Soft Copper Cables for Electrical Conductors (B 158 – 41 T) *Committee B-1.*
Specifications for Copper and Copper Alloys (Committee B-5):
Leaded Red Brass and Leaded Semi Red Brass Sand Castings (B 143 – 41 T).
Leaded Yellow Brass Sand Castings for General Purposes (B 144 – 41 T).
High-Strength Yellow Brass and High-Strength Leaded Yellow Brass Sand Castings (B 145 – 41 T).
Leaded Nickel-Brass (Leaded Nickel-Silver) and Leaded Nickel-Bronze (Nickel-Silver) Sand Castings (B 146 – 41 T).
Tin-Bronze and Leaded Tin-Bronze Sand Castings (B 147 – 41 T).
High-Leaded Tin Bronze Sand Castings (B 148 – 41 T).
Aluminum-Bronze Sand Castings (B 149 – 41 T).
Aluminum-Bronze Rods, Bars, and Shapes (B 150 – 41 T).
Copper-Nickel-Zinc Alloy Rod and Wire (B 151 – 41 T).
Copper Sheet, Strip, and Plate (B 152 – 41 T).
Leaded Red Brass (Hardware Bronze) Rods, Bars, and Shapes (B 140 – 41 T).
Methods of Testing (Committee B-4):
Test for Temper of Strip and Sheet Metals for Electronic Devices (Spring-Back Method) (B 155 – 41 T).
Testing Lateral Wire for Grids of Electronic Devices (B 156 – 41 T).
Testing Wire for Supports Used in Electronic Devices and Lamps (B 157 – 41 T).
Methods of Testing (Committee B-5):
Test for Expansion (Pin Test) of Copper and Copper-Alloy Tubing (B 153 – 41 T).
Mercurous Nitrate Test for Copper and Copper Alloys (B 154 – 41 T).

Fire Tests, Concrete, Mortar, Masonry Units

Specifications for:
Ready-Mixed Concrete (C 94 – 41 T) (revision of standard) *Committee C-9.*
Mortar for Reinforced Brick Masonry (C 161 – 41 T) *Committee C-12.*
Vitrified Clay Filter Block for Trickling Filters (C 159 – 41 T) *Committee C-15.*
Method of:
Test for Fire-Retardent Properties of Wood (C 160 – 41 T) *Committee C-5.*

Glass and Glass Products

Definition of:
The Term Glass (C 162 – 41 T) *Committee C-14.*

Thermal Insulating Materials

Methods of Testing (Committee C-16):
Sampling and Preparation of Specimens for Testing of Thermal Insulating Cements (C 163 – 41 T).
Test for Bulk Density of Thermal Insulating Cement (C 164 – 41 T).
Test for Compressive Strength and Flexural Strength of Preformed Block Type Thermal Insulating Materials (C 165 – 41 T).
Test for Covering Capacity and Volume Change Upon Drying of Thermal Insulating Cements (C 166 – 41 T).
Test for Thickness and Density of Blanket Type Thermal Insulating Materials (C 167 – 41 T).
Definitions of:
Terms Relating to Thermal Insulating Materials (C 168 – 41 T) *Committee C-16.*

Pigments and Paint

Specifications for Paint Materials (Committee D-1):
Liquid Paint Driers (D 600 – 41 T).
Oiticica Oil (Permanently Liquid) (D 601 – 41 T).
Barium Sulfate Pigments (D 602 – 41 T).
Aluminum Silicate Pigment (D 603 – 41 T).
Diatomaceous Silica Pigment (D 604 – 41 T).
Magnesium Silicate Pigment (D 605 – 41 T).
Lead Titanate (D 606 – 41 T).
Mica Pigment (D 607 – 41 T).
Dibutylphthalate (D 608 – 41 T).
Methods of Testing (Committee D-1):
Test for Color of Orange Shellac (D 29 – 41 T) (supplement to a standard).
*Test for Specular Gloss of Paint Finishes (D 523 – 41 T).
*Testing Liquid Driers (D 564 – 41 T).
Preparation of Steel Panels for Exposure Tests of Enamels for Exterior Service (D 609 – 41 T).
Evaluating Degree of Resistance to Rusting Obtained with Paint on Iron or Steel Surfaces (D 610 – 41 T).
Definitions of:
*Terms Relating to Paint, Varnish, Lacquer, and Related Products (D 16 – 41 T) *Committee D-1.*

Petroleum Products and Lubricants

Specifications for:
Aviation Gasolines (D 615 – 41 T) *Committee D-2.*
Methods of Testing (Committee D-2):
Test for Knock Characteristics of Motor Fuels (D 357 – 41 T) (revision of standard).
*Test for Gum Stability of Gasoline (D 525 – 41 T).
*Test for Neutralization Number of Petroleum Products and Lubricants (D 188 – 41 T).
*Test for Sulfur in Petroleum Oils by Lamp Method (D 90 – 41 T).
*Test for Saponification Number (D 94 – 41 T) (*also, Committee D-9*).
Test for Aniline Point of Petroleum Products (D 611 – 41 T).
Test for Carbonizable Substances in Paraffin Wax (D 612 – 41 T).
Test for Ignition Quality of Diesel Fuels (D 613 – 41 T).
Test for Knock Characteristics of Aviation Fuels (D 614 – 41 T).

Road and Paving Materials

Methods of:
Test for Modified Miscibility and Cement Mixing of Emulsified Asphalts (D 244 – 41 T) (supplement to a standard) *Committee D-4.*

Electrical Insulating Materials

Specifications for:
Round Phenolic Laminated Tubing for Radio Applications (D 616 – 41 T) *Committee D-9.*
Methods of Testing (Committee D-9):
*Test for Power Factor and Dielectric Constant of Electrical Insulating Materials (D 150 – 41 T).
Test for Punching Quality of Phenolic Laminated Sheets (D 617 – 41 T).
Test for Preconditioning Plastics and Electrical Insulating Materials (D 618 – 41 T) (*also, Committee D-20*).
Test for Volatile Matter Content of Vulcanized Fiber (D 619 – 41 T).

Rubber

Methods of Testing (Committee D-11):

Testing Automotive Air Brake and Vacuum Brake Hose (D 622 – 41 T).
Test for Compression Fatigue of Vulcanized Rubber (D 623 – 41 T).
Test for Tear Resistance of Vulcanized Rubber (D 624 – 41 T).

Soaps and Other Detergents

Specifications for Soaps (Committee D-12):

Olive Oil Chip Soap (Type A, Pure; Type B, Blended) (D 630 – 41 T).
*Palm Oil Chip Soap (Type A, Pure; Type B, Blended) (D 536 – 41 T).

Methods of Testing (Committee D-12):

Test for Carbonates as Carbon Dioxide in Soaps and Soap Products (D 460 – 41 T) (supplement to a standard).
*Sampling and Chemical Analysis of Special Detergents (D 501 – 41 T) (supplement to a standard).

Definitions of:

*Terms Relating to Soaps and Other Detergents (D 459 – 41 T) *Committee D-12.*

Textiles

Specifications for Textile Materials (Committee D-13):

Medium-Weight Cotton Corduroy Fabrics (D 625 – 41 T).
Fire-Retardant Properties of Treated Textile Fabrics (D 626 – 41 T).
*Bleached Cotton Broadcloth (D 504 – 41 T).

Methods of Testing (Committee D-13):

Test for Commercial Weight of Continuous Filament Rayon Yarns (D 258 – 41 T) (supplement to a standard).
Test for Commercial Weight of Spun Rayon Yarns and Threads (D 507 – 41 T) (supplement to a standard).
Test for Evaluating Compounds to Increased Resistance of Fabrics and Yarns to Insect Pests (D 627 – 41 T).
Testing Asbestos Tubular Sleeving (D 628 – 41 T).
Quantitative Analysis of Textiles (D 629 – 41 T).
*Test for Resistance of Textile Fabrics and Yarns to Insect Pests (D 582 – 41 T).
*Test for Hard Scoured Wool in Wool in the Grease (Laboratory Scale Operations) (D 584 – 41 T).

Plastics

Methods of Testing (Committee D-20):

Preconditioning Plastics and Electrical Insulating Materials (D 618 – 41 T) (*also, Committee D-9*).
Test for Color Fastness of Plastics to Light (D 620 – 41 T).
Test for Deformation of Plastics Under Load at Elevated Temperatures (D 621 – 41 T).

Standards and Tentative Standards Withdrawn and Replaced

Actions at the annual meeting based on the various standing committee recommendations as detailed in the preprinted reports resulted in the withdrawal of a number of standards and tentative standards.

In reviewing the accompanying list, it should be kept definitely in mind that in a great many cases the items withdrawn have been replaced by other specifications or tests accepted at the 1941 meeting (these are listed under New and Revised Tentative Standards) or in a few cases by items issued previous to this year.

Full details of all of the actions affecting the standards and tentative standards are given in the Summary of Proceedings which is being sent to each member in a separate mailing.

Specifications for:

Manganese-Bronze Ingots for Sand Castings (B 7 – 39), replaced by new Tentative Specifications.
Manganese-Bronze Sand Castings (B 54 – 39), replaced by new Tentative Specifications.
Aluminum-Bronze Castings (B 59 – 39), replaced by new Tentative Specifications.
Portland Cement (C 9 – 38), replaced by new Standard Specifications for Portland Cement (C 150 – 41).
High-Early-Strength Portland Cement (C 74 – 39), replaced by new Standard Specifications for Portland Cement (C 150 – 41).
Foundry Coke (D 17 – 16),
Specifications and Methods of Test for Cuban (Jute) Raw Sugar Bags (D 275 – 33),
Specifications and Methods of Test for Asbestos Yarns (D 299 – 37), replaced by new Tentative Specifications.
Sand Castings of the Alloy: Copper 80 per cent, Tin 10 per cent, Lead 10 per cent (B 74 – 32 T), replaced by new Tentative Specifications.

Methods of:

Test for Uniformity of Coating by the Preece Test (Copper Sulfate Dip) on Zinc-Coated (Galvanized) Iron or Steel Wire (A 191 – 38) and on Steel Castings and Forgings, Gray-Iron and Malleable-Iron Castings (A 208 – 38 T), replaced by new Standard Method A 239 – 41.
Compressive Strength of Natural Building Stone (C 98 – 30 T).
Sampling Natural Building Stone and Preparation of Sample for Testing (C 101 – 32 T),
Tension Testing of Natural Building Stone (C 103 – 32 T),
Test for Knock Characteristics of Motor Fuels (D 357 – 40), replaced by new Tentative Specifications.

Definitions of:

Terms Relating to Natural Building Stone (C 104 – 31 T).
Term Coke (D 121 – 26 T).

Standardization Projects Under Way

Numerous Specifications and Testing Procedures Being Developed

QUITE A NUMBER OF the standing committees of the Society plan to refer proposed new specifications or tests or proposed revisions to Committee E-10 on Standards at its meeting on August 25. In addition to these items which together constitute quite a lengthy list, committees have programs under way which will undoubtedly result in many additional proposed new standards next year.

The following paragraphs contain information on certain standardization projects, for the most part supplementing information given in the current reports presented at the 1941 annual meeting.

Ferrous Metals

As a result of studies under way for many months, Committee A-1 on Steel will ask approval of proposed new specifications covering Electric-Resistance-Welded Carbon-Molybdenum Alloy-Steel Boiler and Superheater Tubes and Atomic-Hydrogen Arc Welded and Electric-Resistance-Welded Alloy-Steel Boiler and Superheater Tubes. A number of other studies are under way in the field of pipe and tubing, namely, rationalization of elongation requirements, flattening test requirements, etc. In the field of bolting materials for high-temperature service (A 193), the possibility of covering in a separate specification one particular composition which is rather widely used is under consideration.

The committee on wrought iron is continuing its preparation of specifications for finished staybolts, crown bars, and similar products. In the field of cast iron, Committee A-3 will advance its work on new specifications for pig iron which involves possible correlation of the requirements of other organizations. Changes in the requirements for cast iron locomotive cylinders (A 45 – 14) are imminent.

In work on specifications for metallic coated products, Committee A-5 on Corrosion of Iron and Steel with the

issuance of revised Federal specifications is in a position to reconcile differences, which undoubtedly will involve revisions in specifications for galvanized iron or steel sheets (A 93 - 38 T). The existing specifications for zinc-coated iron or steel chain-link fence fabric galvanized after weaving (A 117 - 33) are being modified and extensive revisions in the specifications for zinc coating on hardware and fastenings (A 153 - 33 T) are in the offing. As the basis for possible changes in the aluminum content of zinc coatings for structural steel, the committee is exposing a number of sheet steel specimens with varying aluminum content in the coating.

The committee on ferro-alloys reports some progress in the preparation of requirements for silicomanganese, ferrotitanium, and ferroboron.

Among the projects under way in Committee A-10 on Iron-Chromium, Iron-Chromium-Nickel and Related Alloys are specifications to cover stainless steel tubing for general corrosion resistance at normal and slightly elevated temperatures, also the same material fabricated by welding. Also stainless material for sanitary tubing fabricated by the seamless and welded process.

Sufficient experience having been obtained, Committee E-4 on Metallography plans to include in the present Tentative Methods of Preparation of Metallographic Specimens (E 3) procedures governing the use of electrolytic polishing. Its work on X-ray diffraction includes drafting in A.S.T.M. style five of the most generally used methods, which may be referred to the Society for approval during the coming year. A recommended practice for dilatometric analysis is being developed.

Of extreme importance is Committee E-4's work involving the development of standard ferrite grain size charts and non-ferrous grain size recommendations. Other work of this active group includes laboratory tests for the determination of inclusions and comparative work on testing identical samples for inclusion rating.

Non-Ferrous Metals

Among the several projects under way in Committee B-1 on Copper and Copper-Alloy Wires for Electrical Conductors are standardized definitions for rounded edges of wire. Other work involves the design of a suitable trolley wire gage, and specifications for lead alloy covering for copper wire are being developed. Drafts of requirements for tinned-hard or medium-hard copper wire for electrical conductors are being studied.

In its work on refined nickel and high-nickel alloys, Committee B-2 on Non-Ferrous Metals and Alloys has completed nine proposed new specifications covering plate, sheet and strip, rods and bars, and for pipe fabricated from nickel, nickel-copper alloy, and nickel-chromium-iron alloys. It is expected these will be referred to Committee E-10 for approval this month.

Projects in the field of Committee B-4 on Electrical-Heating, Electrical-Resistance and Electric-Furnace Alloys include the study of a bend test to replace the indentation hardness test for determining the temper of thermostat metals, development of specifications for round nickel wire for use in electronic devices and a procedure for testing welds for incandescent lamps and electronic devices.

Committee B-5 on Copper and Copper Alloys, Cast and Wrought has a number of standardization activities under way including the sponsoring of a special compilation of the standards in its field. Proposed standards for phosphor-bronze rod and phosphor-bronze wire have been completed and are being referred to Committee E-10 for approval. The committee also plans to indicate in its specifications the type of information that the purchaser of the material should include on his order. One of the important developments during the year was the organization of a new consumer subcommittee on tolerances which is to cooperate with manufacturers.

Reference is made in another article in this Bulletin dealing with A.S.T.M. National Defense Projects to the work of Committee B-6 on Die-Cast Metals and Alloys and the possible reduction of aluminum in certain zinc-base alloys.

In the specifications for light metals and alloys a number of important revisions have been made, Committee B-7 attempting to cooperate closely in connection with National Defense efforts. An alloy nomenclature system is being developed.

"C" Committee Group—Fire Tests, Lime, Refractories, Mortars, Glass, etc.

An outstanding achievement of Committee C-5 on Fire Tests of Materials and Construction was the completion of a new standard test covering the fire-retardant properties of wood, based on an exhaustive experimental study. Further considerations will be given during the year to other proposals in this field. Another important study involves the procedure of recording the evolution of smoke by door assemblies exposed to fire.

Further revisions in the specifications for hydrated limes for structural purposes will be based on data now being obtained by Committee C-7 covering service performances and investigations of laboratory tests which might be used as a basis for specifications. A laboratory procedure on the slaking process and a test method for determining settling rates for lime products are two other standardization projects.

Activities in the field of refractories involve comparative studies of gas-fired and electric furnaces for obtaining the pyrometric cone equivalent. Specification requirements for fireclay plastic refractories and quality specifications for ground fire clay for patching and daubing mixes; also requirements for air-setting mortars, are other current problems.

Committee C-9 on Concrete and Concrete Aggregates has as an extensive list of active projects—some are of a distinct research nature, others are directly allied to the development of standard specifications or tests. The work on methods and apparatus continues in several phases, one involving tests for making concrete specimens from vibrated concrete, another a method of measuring cores drilled from a concrete structure, and a third determining the volume of entrained air. A test for determining the elastic properties of concrete is being developed and other broad projects involve conditions affecting durability and the relation of characteristics of materials and mixtures to concrete properties.

The annual report of Committee C-12 on Mortar for Unit Masonry announced that specifications for mortar for glass products had been drafted and are being studied. Progress is reported in the work on mortars for concrete

units. Various methods for measuring plasticity are being completed.

Committee C-14 on Glass and Glass Products, which has active work under way in several fields is continuing its endeavors to develop a test for determining the thermal endurance of glass. The referee and routine methods for chemical analysis of soda-lime glass are being referred to Committee E-10 on Standards for approval as new A.S.T.M. tests.

Committee C-15 on Manufactured Masonry Units is preparing new specifications for structural clay facing tile and for glazed brick and tile. Facing tile have plain (unscored) exposed surfaces but are not glazed. They resemble ordinary structural clay tile in all respects except for uniformity of dimensions, color, and texture.

The current specifications for glazed building units (C 126 – 39 T) have been under revision for the past two years. Significant progress has taken place in the industry during this time, resulting in finishes that are more durable and the production of units which meet closer dimensional tolerances than are now required. As the result of a survey made by the industry, the committee is now prepared not only to improve the methods of testing but also to formulate a new set of standard dimensions for glazed units.

In preparation of extending its work covering thermal insulating materials for building, Committee C-16 has expanded its personnel. It has participated in the work of the Joint Committee on Thermal Conductivity of all Forms of Insulation of which Dr. F. C. Houghten, Director, Research Laboratory, American Society of Heating and Ventilating Engineers, is chairman. This Joint Committee has completed a description of a proposed standard hot plate apparatus for determining thermal conductivity and tests are being made of a standard set of specimens to make certain that standard apparatus will yield nearly identical results in different laboratories.

The Committee on Natural Building Stones, C-18, will continue its formulation of definitions which are very important in this field. A new test for compressive strength has been drafted and is nearing completion and a proposed testing procedure for determining the hardness is being developed. While the work on quality specifications is related closely and is contingent on the development of definitions, the subcommittee in charge is studying a proposed draft submitted by the limestone industry and will consider proposals from other groups in the fields of marble, sandstone, and granite. The committee is accumulating data on surface finishes for various types of stone.

"D" Committees—Petroleum, Coal, Paper, Rubber, Textiles, etc.

There is intense interest in the work of Committee D-1 on Paint, Varnish, Lacquer, and Related Products involving accelerated tests for protective coatings carried on in its Subcommittee VII. Through the work of this group two important new standards were approved this year covering preparation of steel panels for exposure tests of enamels for exterior service and method for evaluating the resistance to rusting on painted iron or steel surfaces. Specification requirements for aluminum panels are being studied. In other phases of D-1 activity, a test procedure for consistency of house paints is progressing; also development of a spatula leafing method for aluminum powder and paste. The studies involving physical properties of materials are actively under way and a tentative standard for use of the I.C.I. method in the specification for color is being developed. Work in this field also involves tests for adhesion of paint or varnish films and a procedure for preparing uniform paint films.

Of the numerous projects in Committee D-2 on Petroleum Products and Lubricants, the following are particularly active: a test program on methods for determining oil content of paraffin wax; development of the filter aid method for testing used oils; revisions in the test for water and sediment in petroleum products (D 96) involving the use of centrifuges with diameters of swing from 16 to 22 in. and bath temperature of 140 F.; also, study of rusting and oxidation tests for turbine oils.

The gaseous fuels committee, D-3, is not yet prepared to recommend standards but has a number of investigations under way. Important research has been conducted, notably on the determination of specific gravity and density of gaseous fuels, and on complete analysis or chemical composition of gaseous fuels. The extensive work on water vapor content conducted at Penn State and covered in the annual meeting paper by Doctor Gauger will probably result in the drafting of two methods which will be investigated in different laboratories and under field conditions.

Committee D-4 on Road and Paving Materials has a number of recommendations to submit to the Committee on Standards at its August meeting including proposed new specifications for sodium chloride; revisions of standard methods of analysis of calcium chloride; revised requirements for slow setting emulsified asphalt for fine aggregate mixtures and tentative volume correction table for tar and coal-tar pitch.

Committee D-5 on Coal and Coke, which has done so much to place the evaluation of properties of coal on a rational basis, will continue the work on effect of various atmospheres in the coal ash fusion test; also, cooperative checks will be made by laboratories investigating volumetric methods for determining sulfur and a mathematical study is being made to show how closely the same laboratory can check in duplicate determinations when analyzing coal by the standard procedure. A large number of laboratories are submitting check results.

The "Lea-Nurse" method for determining particle size has been shown to be applicable for measuring the new surface produced in grinding coal and this will be studied. The drop shatter test for coal (D 440) and the tumbler test (D 441) will probably be revised, since for some coals the published methods may give misleading results. Investigations will be continued of methods now used for measuring swelling characteristics of coal in coke ovens during carbonization, in particular tests that measure the pressure developed on oven walls. The method under investigation covering ignitibility is to be drafted in standard form so that various laboratories can use it and report results.

In its work on methods of test for paper and paper products, Committee D-6 continues its active program and will submit to Committee E-10 for publication as new A.S.T.M. standards six procedures covering the following: quanti-

tative determination of moisture in paper; folding endurance of paper; basis weight of paper; thickness of paper and paper products; method for conditioning paperboard and fiber boxes for testing; and for compression tests of corrugated and solid fiber boxes.

An elaboration of standardization work in Committee D-9 on Electrical Insulating Materials would need to be quite extensive. Much of the committee work involves the obtaining of reliable data before tests or specifications can be prepared and there are many round-robin tests under way. As an example of some of the difficulties involved in this work, the development of a test for determining the resistance of varnish to acid and alkali can be cited. Several years have been devoted to research and considerable more work will have to be done to eliminate certain irregularities in the proposed procedure. After considerable work involving the effect on tensile strength of different molds, a design developed after studies of recent test results is to be prepared and submitted for approval to the subcommittee on molded insulating materials.

Committee D-9 plans to submit to the Society this month a proposed test for product uniformity of phenolic laminated sheet and a test for power factor and dielectric constant of certain materials parallel to the lamination. Resulting from a group study of three different types of micrometers which indicated that the dead-weight type is equal to the machinists' in accuracy, an alternative method of thickness determination with the dial gage will be prepared for inclusion in the existing methods of test for thickness of solid electrical insulation (D 374 - 36 T).

The work of Committee D-20 on Plastics is of particular significance in connection with National Defense efforts. One group is conducting studies on test methods for plastic bearing materials and their frictional properties. Proposed tests for clarity, surface brightness, and surface irregularities are being investigated in round-robin tests. Other work which will lead to standardized procedures involves evaluating weathering resistance, resistance to heat, and permeability of plastics to water vapor.

In standardization work on soaps and detergents in the charge of Committee D-12, there are several interesting phases including preparation of performance tests for dry cleaning and sulfonated detergents, which involve the development of a test of evaluating detergency. Specifications for the following will be developed: potash and liquid soaps, scouring powders and grit soap. Methods of analyzing metal cleaners are being considered, and because of its relation to the standardization work, the monograph on soaps and other detergents and their use is to be studied and further work will be done on it.

The drafting of a recommended classification of soils is a project of Committee D-18; also, preparation of a method covering swelling or expansive properties. The test for determining specific gravity is being distributed to the main committee for information and comment. The difficult question of testing procedures for stabilization is being tackled from the standpoint of a test to be used regardless of the type of admixture. In its work on bearing capacity of soils in place and of piles a test for the former has been drafted and is being studied by the individual subcommittee members, and it is expected the procedure for bearing capacity of piles will be submitted soon.

Since there is incorporated in the BULLETINS following the Fall and Spring meetings of Committee D-13 on Textile Materials a statement concerning the major research and standardization projects under way, these items will not be elaborated here. Each of the D-13 subcommittees and sections has a number of important standards activities. Its work on household and garment fabrics, for instance, includes such topics as tests for determination of degree of mercerization, serviceability test for bed sheeting and household fabrics; and specification requirements for outing flannel, blanketing, work garment and upholstery fabrics.

Among the current activities of Committee D-19 on Water for Industrial Uses is a study and tabulation of data obtained from committee members on the sampling of boiler water and steam, from which is expected to result a draft of proposed standard methods. Methods for determining the hardness of dissolved oxygen and the three elements, iron, magnesium, and silica will be studied—in some cases there are alternate methods proposed. A rather involved problem on classification of industrial waters is to be approached from the standpoint of classifying the plant supply water.

The chairman of Committee D-19, Max Hecht, 1635 Beechwood Boulevard, Pittsburgh, Pa., will be glad to send to any A.S.T.M. member who would like to offer comment a copy of Methods of Testing Zeolite Materials which has been developed after several years work in the American Water Works Association. A joint committee consisting of representatives from various interested railroad, utility, and boiler manufacturers, the Joint Committee on Boiler Feedwater Studies, and A.S.T.M. is to review sections of the A.S.M.E. Boiler Construction Code covering chemical treatment and control of boiler water. The chairman of Committee D-19 has been designated the A.S.T.M. representative and comments of A.S.T.M. members should be forwarded directly to him.

The Highway Research Board Publications

THE PROCEEDINGS of the Twentieth Annual Meeting of the Highway Research Board exceed by almost 50 per cent the corresponding volume for the previous annual meeting.

Following a report of the Department of Finance of which T. H. MacDonald is chairman, there is an extended Symposium on Highway Planning which subject is part of the work of the Department of Highway Transportation Economics. Matters of design cover some 330 pages. The Department of Materials and Construction which follows this should be of interest to many A.S.T.M. members, covering relation of cores and pavement quality, freezing and thawing investigations, report on mineral aggregates, and equipment for evaluating road surface roughness. There are a number of reports and papers comprising the remaining portion of the Proceedings devoted to maintenance, traffic and safety, and soils, the latter being arranged under two headings: soil mechanics and soil stabilization.

This volume of almost 900 pages bound in cloth can be obtained from the Highway Research Board, National Research Council, 2101 Constitution Ave., Washington, D. C., at $2.75 per copy.

1941 Report of the Joint Research Committee on Boiler Feedwater Studies to the American Society for Testing Materials[1]

During the past year the Joint Research Committee on Boiler Feedwater Studies has continued its activities along the lines followed during the several preceding years. The committee and its members have participated actively in three important meetings: first, the spring meeting of the American Society of Mechanical Engineers in Worcester, Mass., in May, 1940, at which was sponsored a boiler feedwater session with several papers discussing the technical paper presented at the previous spring meeting by Messrs. E. P. Partridge and R. E. Hall on the subject, "Attack on Steel in High-Capacity Boilers as a Result of Overheating Due to Steam Blanketing." These papers were issued in A.S.M.E. publications. At this meeting also a technical paper on steam purity prepared by Messrs. Guerney and Schwartz of the Gulf States Utility Co. was presented.

The second meeting was that of the Mechanical Division of the Association of American Railroads held in Chicago, in June, 1940, at which Doctor Schroeder presented a summary of the work on caustic embrittlement being carried out under the auspices of the committee at the Eastern Experiment Station, U. S. Bureau of Mines.

At the annual meeting of the A.S.M.E. held in December, 1940, in New York City, another boiler feedwater session was sponsored by the committee. A paper emphasizing the problems created by the presence of silica in boiler feedwater and boiler water was presented followed by two papers discussing the latest processes by which silica can be removed from boiler feedwaters. Reprints of these papers can be obtained by addressing requests for them to the chairman of the Joint Research Committee on Boiler Feedwater Studies.

The principal research activities of the committee during the past year have been confined to the continued study of the problem of caustic embrittlement as carried on under the auspices of Subcommittee VI at the Bureau of Mines, Eastern Experiment Station at College Park, Md.

It is unfortunate that this research work has not, before this time, yielded such definite and conclusive results as to make it possible to recommend specific measures by which freedom from caustic embrittlement could be assured even though boilers might be constructed with leaking seams. The problem has been too complicated and presented too many unsatisfactorily explained contradictions to make that possible.

The committee set out to determine what the fundamental reactions were that caused this phenomenon of boiler metal cracking. This course was undertaken when the initial studies to determine the solubility of sodium sulfate in boiler waters led to disclosures indicating that embrittlement could not be inhibited in all instances when that salt was used as a preventive reagent.

After the basic reactions in the development of embrittlement were better understood, it was sought to determine those steps necessary to prevent its occurrence. This study has had many ramifications including:

(*a*) The development of several types of apparatus by which it would be possible to determine if a given boiler water would cause metallic specimens to crack,

(*b*) a conscientious effort to correlate with the findings of the Bureau of Mines' study the work of the University of Illinois, which in all phases did not agree with the results of the committee's research, and

(*c*) the critical examination and testing of several preventive chemical reagents.

Even today it is not possible to recommend a simple reagent that under all conditions of either stationary or locomotive boiler operation will assuredly prevent intercrystalline corrosion and ultimate boiler metal cracking.

Three reagents have been discovered to prevent effectively the cracking of specimens subjected to actual boiler waters in the test equipment adapted for the purpose. How well these reagents will function to prevent cracking of the metal of the boiler in service cannot be told until years of experience with them have yielded the story, because no matter how well a test is devised to demonstrate the effect of such reagents on a *specimen*, the conclusions drawn must always and only concern the specimen and not an assembly of the same metal, as a boiler.

This may seem like an argument in justification for work that has not been more conclusive. It is regrettable if it should seem so, because, as a matter of fact these studies have yielded what is actually as important a result as that of finding a way to stop boiler metal cracking. It has led to the development of a test apparatus and procedure whereby each boiler operator can determine for himself if the water in any one boiler is capable of corroding the boiler metal in an intercrystalline manner from which embrittlement results.

This apparatus is referred to as an embrittlement detector and its extensive use attached to both stationary and locomotive boilers is covering a wide variety of operating conditions. The National Aluminate Corp., the Dearborn Chemical Co., W. H. & L. D. Betz, and the Hall Laboratories, Inc., have cooperated in distributing these detectors and collecting test data. Somewhat over a hundred are now in use on operating boilers.

It may be appropriately stated that the present funds available to Subcommittee VI are expected to be consumed during the current year and consideration is being given to instituting new research work, by which the research staff at the Bureau may be continued to be employed on boiler feedwater projects. It is to be noted in connection with the work of Subcommittee VI that the Bureau of Mines has to a large extent underwritten the cost of much of the research work during the past two years. The officers of the Joint Research Committee desire to take this

[1] Presented at the Forty-fourth Annual Meeting, Am. Soc. Testing Mats., Chicago, Ill., June 23–27, 1941.

opportunity to express publicly their appreciation of this assistance.

The Subcommittee on Patents issued its fourth progress report that covers all patents for the year 1939 on water treating and water-treating equipment. In an effort to determine how useful the report of this subcommittee has been to industry, the committee authorized the printing and sale of this current report. Individual copies could be procured at a nominal cost from the secretaries of the six sponsoring societies, although the principal point of distribution is the A.S.M.E. headquarters. At its executive committee meeting held in December, 1940, the Joint Research Committee decided that further elaborate efforts on the part of Subcommittee IX on patents would be discontinued, inasmuch as there was not enough apparent interest on the part of industry to justify this continued effort. The executive committee regretted exceedingly that this action was necessary.

At the meeting of the executive committee consideration was given to possible programs under the sponsorship of the Joint Research Committee at the annual meeting of the American Waterworks Association and of the American Society for Testing Materials, as well as another meeting to be held in connection with that of the Mechanical Division of the American Association of Railroads. It was later found, however, that due to conflicts and nature of the programs of some of these organizations it was more expedient to drop any consideration of a separate boiler feedwater session at these meetings. In lieu of this, officers of the Joint Research Committee will present formal reports to the sponsoring societies and discuss personally details of the work of the committee.

Current plans call for a symposium on the subject of caustic embrittlement and intercrystalline corrosion of boiler steel to be held in connection with the annual meeting of the American Society of Mechanical Engineers in December, 1941. At this symposium it is the intent that the individual students of the problem will present such data as may have resulted from their studies and thus make available for general discussion what may be considered to be a true cross-section of the industry's feeling with respect to the problem. There is in preparation at the present time a summary of the entire research program of Subcommittee VI relating to embrittlement which it is planned will be issued as a Bureau of Mines' bulletin under the joint sponsorship of the Bureau of Mines and Joint Research Committee on Boiler Feedwater Studies. It is expected that this will be available shortly after the first of the year.

The officers of the Joint Research Committee on Boiler Feedwater Studies would like to take this opportunity to express their keen appreciation of the cooperation that has been given them by the members and officers of this Society.

Respecfully submitted on behalf of the committee,

C. H. Fellows, *Chairman*
Detroit Edison Co.

J. B. Romer, *Secretary*
Babcock & Wilcox Co.

Review of the Inter-Society Color Council Work

The Society's delegates to the Inter-Society Color Council have submitted a brief annual report which is published below. There has been, as the report indicates, a definitely accelerated interest in color, and the work of the Council has intensified. A number of A.S.-T.M. committees are particularly concerned with its activities and the delegates who represent the Society are active in committee work, thus tying in the A.S.T.M. interests. In addition to M. Rea Paul, Consultant to Protective Coatings Section, Division of Purchases, Office of Production Management, and secretary of the Society's Committee D-1 on Paints, who is chairman of the delegates, the group includes the following: A. G. Ashcroft, Alexander Smith and Sons Carpet Co.; C. E. Foss, Color Consultant; F. S. Mapes, General Electric Co.; A. E. Parker, Electrical Testing Laboratories; and W. M. Scott, Southern Regional Research Laboratory, U. S. Dept. of Agriculture.

1941 Report

The last year has developed a more active interest on the part of the membership than ever before. This has been made apparent through an increased number of technical sessions, projects, committee meetings, News Letters, and society and association memberships.

A symposium on Spectrophotometry in the Pulp and Paper Industry was jointly sponsored with the Technical Association of the Pulp and Paper Industry, at New York in February of last year. Another Symposium on Color, was jointly sponsored with the Illuminating Engineering Society, at Spring Lake, N. J., in September. The value and interest attached to these programs jointly sponsored by the Council and its member bodies is considerable. The papers from the two symposiums mentioned have been published in full in the journals of the respective societies, and have also been made available in bound form to the Council's members and delegates.

The ISCC-NBS Method of Designating Color, which was one of the Council's projects, has been extended to the colors of objects viewed by transmitted light. In this extended form it is rapidly being introduced into the chemical and botanical monographs of the National Formulary and the U. S. Pharmacopoeia. The applicability of the method to uses other than the description of drugs and chemicals has been studied by several subcommittees. That the method is unsuited to color description in ophthalmology has been reported. Investigation is revealing the fields to which the method applies. There has been an indication that it may probably be extended to the designation of colors quite generally. The method has been described before several member bodies and has been adopted for the presentation of textile color data by Committee D-13 of the American Society for Testing Materials and by the American Association of Textile Chemists and Colorists. Furthermore, the U. S. Department of Agriculture has incorporated the use of certain of these designations in a bulletin on soil colors, now in press, which will include representations in color for all names in the soil color range. This color chart has been made possible by the successful work of the Committee on Obtaining Central Notations of the ISCC-NBS Colors.

During the past year, much time has been devoted to the study of possible alterations in the Council's policies

and in its Articles of Organization and Procedure, so as to insure continuance of the cordial relations between the Council and its member bodies. The newly formed Committee on Public Relations is expected to be of assistance in this regard.

The highlight of the Council's committee work during the past year has been the rapid development of a test for color aptitude. The importance of this test for national defense has been recognized both by the Navy and War Departments who have appointed representatives on this committee to assist in this special project.

An important aim of the Council is to coordinate the color work of its member bodies, and along this line two programs were arranged. A color symposium was jointly sponsored by the Council and the American Society for Testing Materials, held in Washington, D. C., early in March, and a program of papers given in Baltimore the latter part of March, jointly sponsored by the Council and the American Ceramic Society.

The Council has announced that the Federation of Paint and Varnish Production Clubs and the American Artists' Professional League have become member bodies. It is quite fitting that a national association of artists, as well as a national group interested in technical problems of producing paint products, should become interested in the affairs of the Council, for the Council deals with color problems in art, as well as in science and industry.

During the coming year the Council expects to pursue its work of gathering and correlating color-descriptive terms that have been adopted as standard by, or have come into general use in, the member bodies.

The Council furthermore invites constructive suggestions from the societies and associations that compose its membership, as to ways in which it can most beneficially fulfil its function of stimulating and coordinating activities that will lead to the further standardization, description, and specification of color, and to promote the practical application of these results to the color problems arising in science, art, and industry.

Additional Support of Cement Reference Laboratory

THE WORK OF THE Cement Reference Laboratory, which is sponsored jointly at the National Bureau of Standards by the Bureau and A.S.T.M. Committee C-1 on Cement, has been growing in extent and in connection with its most recent tour of inspection by the personnel, requests were received from some 260 laboratories of which some 50 were from state highway departments

For many years, the Public Roads Administration, formerly the U. S. Bureau of Public Roads, has been concerned with the work of the laboratory, and as evidence of this interest, in 1932 the laboratories testing cement for federal aid were required to authorize the C. R. Laboratory to inspect their facilities and to furnish the Bureau copies of the resulting reports. The Public Roads Administration still requires this Cement Reference Laboratory inspection. When additional work, particularly the verification of compression testing machines increased the costs so that it was evident that the field could not be covered as rapidly as in the past, Public Roads gave recognition to the value of this inspection service and agreed to bear a share of the expenses of the field work which is now steadily progressing. Up to this time the expenses have been shared by the National Bureau of Standards and Portland Cement Association, the latter making contributions through the Society.

This laboratory, which has come to be a very important source of betterment in testing of cement, was established to instruct on established methods of making tests; to calibrate cement testing equipment; on request of a laboratory, to report on the adequacy and accuracy of its facilities; and on request to check the methods employed and report on the compliance with standard methods; and also to compare results on check samples with any laboratory or group of laboratories.

The annual reports of Committee C-1 on Cement, to many of which there have been appended reports on the laboratory, have indicated the extent of the work and have shown definitely the very considerable improvement on the part of the various cement testing laboratories in the quality of their equipment and procedures.

Translated Report on Welded Bridge Investigations

THROUGH THE courtesy of the American Institute of Steel Construction, 101 Park Ave., New York, N. Y., whose Director of Engineering, F. H. Frankland, is chairman of the Steel Committee's Subcommittee II on Structural Steel and is otherwise quite active in A.S.T.M. committee work, members of the Society may obtain on request from the Institute a copy of the translation of the German Committee Report No. 10 on Investigations to Improve Field Splicing Conditions of Welded Bridge Girders. This extensive report should be of interest to those engineers and technologists who are concerned with questions of structural welding and weldability. There has been rather extended discussion of these questions in various subgroups of Committee A-1 on Steel, and the American Welding Society and the American Bureau of Welding functioning under the Engineering Foundation are carrying out important work on this and related problems.

City of Los Angeles Uses Large Number of A.S.T.M. Standards

THE PUBLIC WORKS DEPARTMENT of the City of Los Angeles has recently issued in the form of a 360-page compilation the new specifications covering methods and materials used in public work construction in the city. These specifications prepared by the Bureau of Engineering include as essential parts of the materials requirements, references to more than 50 A.S.T.M. specifications and tests. Part II of the publication covers materials and it is in this section that most of the A.S.T.M. references are included.

The A.S.T.M. requirements cover the quality of such materials as cement, lime, various asphaltic products (particularly mixes), tests for clay and concrete pipe, and many other materials widely used in construction work.

The first draft of this new compilation was submitted to the City Council in June, 1940, and after careful review by those concerned the document was adopted by the Council this year.

New Members of District Committees

The Nine District Committees of the Society, which are organized in as many industrial centers, have their personnel arranged so that each year approximately one-third of the membership terms expire. Under this plan of staggering the terms of office, the President of the Society makes annual appointments. There are recorded below the names of those who have been designated by the President to serve on these committees. While usually the terms of office are three years, in some cases, notably New York and Philadelphia, where the committee personnel is being expanded, some of the new appointments are for one and two years.

At the request of New York district officers, the Society Executive Committee has authorized a larger committee. Philadelphia is also increasing its personnel. In general District Committees have from 12 to 20 members.

During the past year the District Committees have been very active along numerous lines in promoting A.S.T.M. interests in their respective areas. Each group decides how best these aims can be achieved. Some have several meetings during the year and others concentrate on one session with perhaps a symposium or group of speakers. During the past year several meetings were held in the Philadelphia area. The Southern California Committee has more or less standardized on sponsoring two outstanding meetings a year, whereas Detroit for a number of years has concentrated on one spring meeting. Various meetings and activities of the District Committees have been described in articles in the ASTM Bulletin. Another example of District Committee activities should be noted, namely, assisting with national meetings of the Society; the excellent work of the Chicago Committee which formed the nucleus for the Committee on Arrangements for the 1941 meeting is a case in point.

In the list which follows, the officers of the District Committees have been included (a complete list of the District Committees will appear in the 1941 Year Book) and there follow names of appointees to respective groups. An asterisk indicates new appointment or new officer.

Chicago

Officers:

E. R. Young, Chairman, Climax Molybdenum Co.
J. de N. Macomb, Vice-Chairman, Inland Steel Co.
C. E. Ambelang, Secretary, Public Service Co. of Northern Illinois

Appointments:

A. H. Carpenter, Armour Institute of Technology
R. B. Harper, The Peoples Gas Light and Coke Co.
C. H. Jackman, Carnegie-Illinois Steel Corp.
A. M. Johnsen, The Pullman Co.
J. E. Ott, Acme Steel Co.
T. H. Rogers, Standard Oil Co. (Indiana)

Cleveland

Officers:

A. J. Tuscany, Chairman, Tuscany, Turner and Associates
Arthur W. Carpenter, Vice-Chairman, The B. F. Goodrich Co.
W. W. Rose, Secretary, Gray Iron Founders' Society, Inc.

Appointments:

R. T. Bayless, American Society for Metals
J. H. Herron, The James H. Herron Co.
G. A. Reinhardt, The Youngstown Sheet and Tube Co.
F. L. Wolf, Ohio Brass Co.
*E. G. Kimmich, Goodyear Tire and Rubber Co.
*R. B. Textor, The Textor Laboratories

Detroit

Officers:

J. L. McCloud, Chairman, Ford Motor Co.
C. H. Fellows, Vice-Chairman, The Detroit Edison Co.
Martin Castricum, Secretary, United States Rubber Co.

Appointments:

C. H. Fellows, The Detroit Edison Co.
W. H. Graves, Packard Motor Car Co.
C. E. Heussner, Chrysler Corp.
J. H. Walker, The Detroit Edison Co.
*Carl B. Fritsche, Reichhold Chemicals, Inc.

New York

Officers:

M. P. Davis, Chairman, Otis Elevator Co.
E. A. Snyder, Vice-Chairman, Socony-Vacuum Oil Co., Inc.
G. O. Hiers, Secretary, National Lead Co.

Appointments:

M. P. Davis, Otis Elevator Co.
H. J. Jaquith, Minot, Hooper & Co.
R. J. McKay, The International Nickel Co., Inc.
L. T. Work, Metal and Thermit Corp.
*G. J. Comstock, Stevens Institute of Technology
*J. G. Detwiler, The Texas Company.
*H. G. Farmer, Universal Atlas Cement Co.
*H. W. Gardner, Polytechnic Institute of Brooklyn
*W. O. Lum, General Electric Co.
*E. P. Pitman, The Port of New York Authority
*W. L. Sturtevant, The Manhattan Rubber Manufacturing Division of Raybestos-Manhattan, Inc.
*T. Smith Taylor, Newark College of Engineering
*Gordon Thompson, Electrical Testing Laboratories
*P. J. Witte, New York City Central Testing Laboratory

Northern California

Officers:

F. M. Harris, Chairman, Pacific Gas and Electric Co.
Dozier Finley, Vice-Chairman, The Paraffine Cos., Inc.
Theo. P. Dresser, Jr., Secretary, Abbot A. Hanks, Inc.

Appointments:

F. M. Harris, Pacific Gas and Electric Co.
R. A. Kinzie, Santa Cruz Portland Cement Co.
M. C. Poulsen, Port Costa Brick Works
*A. G. Jones, General Electric Co.

Philadelphia

Officers:

F. G. Tatnall, Chairman, Baldwin-Southwark Division, The Baldwin Locomotive Works
L. E. Ekholm, Vice-Chairman, Alan Wood Steel Co.
R. W. Orr, Secretary, RCA Manufacturing Co., Inc.

Appointments:

A. B. Bagsar, Sun Oil Co.
W. T. Pearce, The Resinous Products and Chemical Co.
A. O. Schaefer, The Midvale Co.
*G. H. Mains, National Vulcanized Fibre Co.
*Tinius Olsen 2nd, Tinius Olsen Testing Machine Co.
*E. K. Spring, Henry Disston and Sons, Inc.
*L. H. Winkler, Bethlehem Steel Co., Inc.

Pittsburgh

Officers:

F. M. Howell, Chairman, Aluminum Co. of America
J. J. Shuman, Vice-Chairman, Jones & Laughlin Steel Corp.
H. A. Ambrose, Secretary, Gulf Research and Development Co.

Appointments:

Dean Harvey, Westinghouse Electric and Manufacturing Co.
F. M. McCullough, Carnegie Institute of Technology
P. G. McVetty, Westinghouse Electric and Manufacturing Co.
J. J. Paine, City of Pittsburgh, Dept. of Public Works
Thomas Spooner, Westinghouse Electric and Manufacturing Co.
*J. J. Bowman, Aluminum Co. of America

St. Louis

Officers:

Hermann von Schrenk, Chairman, Consulting Timber Engineer
E. J. Russell, Vice-Chairman, Mauran, Russell & Crowell
L. A. Wagner, Secretary, Missouri Portland Cement Co.

Appointments:

F. V. Reagel, Missouri State Highway Dept.
E. O. Sweetser, Washington University
Hermann von Schrenk, Consulting Timber Engineer
*J. A. Nelson, Municipal Testing Laboratory

Southern California

Officers:

John Disario, Chairman, Columbia Steel Co.
*W. C. Hanna, Vice-Chairman, California Portland Cement Co.
E. O. Slater, Secretary, Smith-Emery Co.

Appointments:

F. J. Converse, California Institute of Technology
E. F. Green, Axelson Manufacturing Co.
H. E. Jung, Southern California Edison Co., Ltd.
R. H. Pierson, Gilmore Oil Co.
E. O. Slater, Smith-Emery Co.
*Roy Paine, Aluminum Co. of America
*Scott Rethorst, Vultee Aircraft, Inc.

A.S.T.M. Standards in the Radio Industry

In its Engineering Bulletin No. 38, the Engineering Department of the Radio Manufacturers Association lists a number of A.S.T.M. specifications and test methods covering general purpose materials commonly used in the radio industry. Since there are quite a number of A.S.T.M. members who are directly or indirectly concerned with this industry, the list is published below:

Specifications for:

Cold-Rolled Strip Steel (A 109)
Commercial Cold-Finished Bar Steels and Cold-Finished Shafting (A 108)
Electrodeposited Coatings of Cadmium on Steel (A 165)
Electrodeposited Coatings of Nickel and Chromium on Steel (A 166)
Electrodeposited Coatings of Zinc on Steel (A 164)
Soft or Annealed Copper Wire (B 3)
Tinned Soft or Annealed Copper Wire for Electrical Purposes (B 33)
Aluminum Sheet and Plate (B 25)
Aluminum-Manganese Alloy Sheet and Plate (B 79)
Free-Cutting Brass Rod for Use in Screw Machines (B 16)
Brass Sheet and Strip (B 36)
Phosphor Bronze Sheet and Strip (B 103)
Copper-Nickel-Zinc and Copper-Nickel Alloy Sheet and Strip (B 122)
Soft Solder Metal (B 32)
Zinc-Base Alloy Die Castings (B 86)
Miscellaneous Brass Tubes (B 135)
Flexible Varnished Tubing Used in Electrical Insulation (D 372) (Revision under consideration)
Phenolic Laminated Sheet for Radio Applications (D 467)

Methods of Testing:

Flexible Varnished Tubing Used for Electrical Insulation (D 350)
Dielectric Strength of Electrical Insulating Materials at Commercial Power Frequencies (D 149)
Laminated Tubes Used in Electrical Insulation (D 348)
Sheet and Plate Materials Used in Electrical Insulation (D 229)
Insulation Resistance of Electrical Insulating Materials (D 257)
Power Factor and Dielectric Constant of Electrical Insulating Materials (D 150)
Grading and Classification of Natural Mica (D 351)

The Radio Manufacturers Association is a member of the Society represented by V. M. Graham, Assistant Director, and the group is represented on various Society committees including Committees D-9 on Electrical Insulating Materials and D-20 on Plastics.

Course in Statistics at M.I.T.

A course in industrial statistics extending from September 8 to 20 is to be given at Massachusetts Institute of Technology by Professors G. P. Wadsworth and H. A. Freeman, of the Departments of Mathematics and Economics, respectively. The course is intended for workers in industrial plants and scientific laboratories and is planned to cover modern statistical technique as applied to inspection, design and analysis of factory and laboratory experiments, and to control of the quality of industrial output. Further details can be obtained by contacting Messrs. Wadsworth or Freeman.

New Members to July 21, 1941

Members who follow lists of new members published in each issue of the Bulletin will note a distinct departure in the method of listing them used in this issue for the first time. Instead of arranging them in the three classifications: company, individual and others, and junior members, they are to be listed according to the Society Districts.

First, will be the members in the respective industrial centers where the Society has established District Committees; then will follow the list of new members whose offices and mailing addresses are not in a location where there is an A.S.T.M. district; and finally will be the new members in countries other than the United States and its possessions.

Under this procedure, members in the following district areas will be classified:

Chicago
Cleveland
Detroit
New York City
Northern California (San Francisco)
Philadelphia
Pittsburgh
St. Louis
Southern California (Los Angeles)

This new method is in line with the increased activities of District Committees and will enable a member to check more readily on companies and individuals in his territory which have joined A.S.T.M.

The official name of the new member continues to be set in distinctive type, followed by the address. New sustaining members will be indicated by italic *S* following the listing, and junior members by italic *J*.

The following 80 members were elected from April 25 to July 21, 1941:

Chicago District

Arnold Engineering Co., The, R. M. Arnold, Vice-President and Chief Engineer, 231 S. La Salle St., Chicago, Ill.

Brand, C. S., Physicist, The Arnold Engineering Co., Marengo, Ill.

Frost, R. H., Assistant Chief Engineer, Arens, Inc., 2253 S. Halsted St., Chicago, Ill. [*J*]

*General Electric X-Ray Corp., E. W. Page, Manager, Industrial Sales Dept., 2012 Jackson Boulevard, Chicago, Ill. [*S*]

Haering, D. W., President and Technical Director, D. W.

* See article on Sustaining Members, p. 47.

Haering and Co., Inc., Chicago, Ill. For mail: 3408 W. Monroe St., Chicago, Ill.

Huberty, A. W., Jr., Draftsman and Designer, Weil Pump Co., Chicago, Ill. For mail: 6048 N. Albany Ave., Chicago, Ill. [J]

Kleis, J. D., Research Physicist, Fansteel Metallurgical Corp., 2200 Sheridan Road, North Chicago, Ill.

Koebel, N. K., Director of Research, Lindberg Engineering Co., 2450 W. Hubbard St., Chicago, Ill.

Pei, Ching Pong, Research Engineer, Locomotive Firebox Co., Room 1908, 310 S. Michigan Ave., Chicago, Ill.

Popovich, A. T., Metallurgist, Smith Steel Foundry Co., 1320 S. First St., Milwaukee, Wis.

Cleveland District

Bloom, W. J., Technical Manager, Otiscoloy Sales, The Otis Steel Co., 11014 Detroit Ave., Cleveland, Ohio.

Doster, H. G., Vice-President and Chief Engineer, The Ohio Injector Co., Wadsworth, Ohio.

Wrigley, H. W., Laboratory Technician, Westinghouse Electric and Manufacturing Co., 1216 W. Fifty-eighth St., Cleveland, Ohio.

Detroit District

Boydell Bros. White Lead and Color Co., The, C. W. Boydell, Vice-President and Secretary, 432 E. Lafayette, Detroit, Mich.

Stinson Aircraft, Division of Vultee Aircraft, Inc., A. P. Fontaine, Chief Engineer, Wayne, Mich.

Genesee County Road Commission, G. R. Bennett, Testing Engineer, Court House, Flint, Mich.

New York District

News Syndicate Co., Inc., M. J. Lalone, Chemist, 220 E. Forty-second St., New York, N. Y.

Craig, G. L., Research Engineer, Calumet & Hecla Consolidated Copper Co., Room 1941, 25 Broadway, New York, N. Y.

Foss, C. E., Color Consultant, 1 Washington Mews, New York, N. Y.

Hartzell, R. S., Chemist, Pittsburgh Plate Glass Co., Box 268, Newark, N. J.

Hutchinson, L. B., Chief, Physical Test Section, Brewster Aeronautical Corp., 34-01 Thirty-eighth Ave., Long Island City, N. Y.

Klinger, E. W., Asphalt Engineer, Standard Oil Co. of New Jersey, Room 1620, 26 Broadway, New York, N. Y.

Peters, F. P., Assistant Editor, *Metals & Alloys*, 330 W. Forty-second St., New York, N. Y.

Shank, W. C., Chemical Engineer, Information Dept., Charles Pfizer and Co., 11 Bartlett St., Brooklyn, N. Y. [J]

Sisco, F. T., Assistant Secretary, American Institute of Mining and Metallurgical Engineers, 29 W. Thirty-ninth St., New York, N. Y.

Stearns, M. E., Paint Chemist, R. T. Vanderbilt Co., Inc., 33 Winfield St., East Norwalk, Conn.

Northern California District

Northrop Aircraft, Inc., T. E. Piper, Process Engineer, Hawthorne, Calif.

Sixtus, E. F., Jr., Chief Chemist, Pacific States Steel Corp., Niles, Calif. For mail: 143 Main St., Hayward, Calif. [J]

Philadelphia District

Bendix Aviation Corp., Philadelphia Division, S. S. Kingsbury, Chief Metallurgist, 4700 Wissahickon Ave., Philadelphia, Pa.

Bauer, W. V., Engineering Aide, U. S. Navy Yard, Philadelphia, Pa. For mail: 506 S. Forty-first St., Philadelphia, Pa. [J]

France, R. D., Metallurgist, Frankford Arsenal, Building 42, Philadelphia, Pa.

Vint, A. W., Chief Engineer, Vanity Fair Silk Mills, Reading, Pa.

Pittsburgh District

Greiner, E. W., Chief Chemist, Pittsburgh Limestone Corp., Pittsburgh, Pa. For mail: 503 Johnson Building, New Castle, Pa.

Metzger, R. E., Chemist, Pittsburgh Testing Laboratory, Pittsburgh, Pa. For mail: R. D. 1, Box 305, Turtle Creek, Pa.

Wray, P. R., Manager, Stainless Steel Bureau, Metallurgical Division, Pittsburgh District, Carnegie-Illinois Steel Corp., 470 Frick Building Annex, Pittsburgh, Pa.

Southern California District

Broun, W. F., Marine Engineer and Administrative Assistant to Chief Engineer, California Shipbuilding Corp., Box 966, Wilmington, Calif.

Hathaway, H. T., District Manager, Robert W. Hunt Co., 638 Chamber of Commerce Building, Los Angeles, Calif.

Los Angeles, County of, Public Library, Agnes E. Sycour, Chief Order Librarian, 322 South Broadway, Los Angeles, Calif.

Lovering, E. W., Revere Copper and Brass Incorporated, 124 W. Fourth St., Los Angeles, Calif. [J]

Ostrom, G. E., Director of Research, Chemre Corp., Box 82, Pico, Calif.

University of Southern California, School of Engineering, D. M. Wilson, University Park, Los Angeles, Calif.

Warren, D. R., Structural Engineer, Architects Building, Los Angeles, Calif.

U. S. and Possessions

Other than A.S.T.M. Districts

Auto City Plating Co., Southern Florida Testing Grounds Division, H. E. Adelsperger, Jr., President and Treasurer, Box 666, Dania, Fla.

Boeing Aircraft Co., L. S. Marsh, Staff Engineer, Georgetown Station, Seattle, Wash.

Buffalo Electro-Chemical Co., Inc., M. E. Bretschger, Vice-President, Station B, Buffalo, N. Y.

Continental Rubber Works, H. L. Howland, Rubber Technologist, Erie, Pa.

Curtiss-Wright Corp., Curtiss Propeller Division, R. R. Snyder, Chief Inspector, 1231 Morris St., Indianapolis, Ind.

Exeter Manufacturing Co., N. S. Cassell, Research Chemist, Exeter, N. H.

Jesco Lubricants Co., Claude Johnson, Secretary and Treasurer, 1437 Gentry, North Kansas City, Mo.

Kenwood Mills Laboratory, W. H. Horne, Laboratory Director, Box 1290, Albany, N. Y.

Liberty Limestone Corp., J. C. Lawrence, General Manager of Operations, Rocky Point, Va.

Mosinee Paper Mills Co., J. D. Line, Paper Technical Director, Mosinee, Wis.

National Ready Mixed Concrete Assn., Stanton Walker, Director of Engineering, 951 Munsey Building, Washington, D. C.

Solvay Process Co., The, Nitrogen Division, E. W. Bowen, Chief Engineer, P. O. Drawer 61, Hopewell, Va.

Douglas, T. B., Superintendent, Gulf Portland Cement Co., Box 3046, Houston, Tex.

Dowling, J. H., State Highway Engineer, State Road Department of Florida, Tallahassee, Fla.

Emery, Joseph, Jr., Sampler, Physical Laboratory, Lawrence Portland Cement Co., Thomaston, Me. For mail: 163 Limerock St., Rockland, Me. [J]

Erb, H. O., Preparation Engineer, Bituminous Coal Producers Board, District No. 11, 400 Opera House Block, Terre Haute, Ind.

Findley, W. N., Instructor in Theoretical and Applied Mechanics, University of Illinois, 302 Arthur Newell Talbot Laboratory, Urbana, Ill.

Heath, C. N., Manager, Masonry Service, 1314 Rhodes Haverty Building, Atlanta, Ga.

Johnson, L. H., Chief Engineer, Struthers-Wells Co., Warren, Pa.

Katz, S. H., Principal Chemist, Chemical Warfare Service, Edgewood Arsenal, Md.

Lehmkuhl, W. M., Plant Superintendent, The Flintkote Co., 4500 N. Galvez St., New Orleans, La.

Leslie, R. W., Manager of Refining Operations, Wasatch Oil Refining Co., Woods Cross, Utah.

Mellon, M. G., Professor of Analytical Chemistry, Department of Chemistry, Purdue University, Lafayette, Ind.

Offner, W. W., Engineer, Industrial X-ray Laboratory, 1615 Second Ave., Seattle, Wash.

Smith, J. A., Standard Oil Co. of New Jersey, Baltimore Refinery, Box 5197, Highlandtown Station, Baltimore, Md.

Upson, W. I., Director, Analytical Chemists of Cincinnati, 4 W. Seventh St., Cincinnati, Ohio.

Weir, P. L., Equipment Engineer, Potomac Electric Power Co., Washington, D. C. For mail: 1310 Nineteenth St., N.W., Washington, D. C.

Other than U. S. and Its Possessions

ACRES AND CO., LTD., H. G., S. W. Andrews, Chief Engineer, 1870 Ferry St., Niagara Falls, Ont., Canada.

SIDNEY ROOFING AND PAPER CO., LTD., Logan Mayhew, Managing Director, Box 940, Victoria, B. C., Canada.

ALEXANDER, J. B., Chief, Timber Mechanics Division, Forest Products Laboratory, University of British Columbia, Vancouver, B. C., Canada.

BAHRNER, VIKTOR, Engineer, Svenska Cementforeningen, Malmö, Sweden.

BAXTER, J. G., General Works Manager, Associated Portland Cement Manufacturers, Ltd., Rosherville Court, Burch Road, Gravesend, Kent England.

DAWSON, W. J., Chief Metallurgist and Director, Hadfields, Ltd., Hecla Works, Sheffield, England.

FERREZ, M. J. M., Ejenhiro, Associacao Brasileira Tecnicas, 61 Benjamin Constant, Sao Paulo, Brazil.

GIBSON, W. A., Consulting Engineer, 29–33 Wilson St., Redfern, Sydney, Australia.

ORIEL, J. A., Chief Chemist, The Asiatic Petroleum Co., Ltd., St. Helen's Court, Great St. Helen's, London, E. C. 3, England.

PELUFFO, AMÍLCAR, Engineer, Compañia Nacional de Cementos, S. A., Pan de Azúcar, Uruguay.

ROSS, G. R. P., Senior Chemist, The Forestal Land, Timber and Railways Co., Ltd., Central Laboratories, Harpenden, Hertfordshire, England.

Sustaining Member	1
Corporation Members	20
Individual and Other Members	51
Junior Members	8
	80

PERSONALS

• • • News items concerning the activities of our members will be welcomed for inclusion in this column.

J. D. SULLIVAN, Chief Chemist, Battelle Memorial Institute, Columbus, Ohio, has been elected chairman of the Electrothermic Division of the Electrochemical Society, an international group of industrial scientists.

At the recent annual business meeting of the American Foundrymen's Association, L. N. SHANNON, Vice-President, Stockham Pipe Fittings Co., Birmingham, Ala., was elected a director to serve for three years. C. E. HOYT, Executive Vice-President, Treasurer and Manager of Exhibits, A.F.A., is relinquishing his duties as Executive Vice-President and Treasurer, and C. E. WESTOVER, Burnside Steel Foundry Co., Chicago, has been appointed to these offices. Mr. Hoyt retains his position as Exhibit and Convention Manager of the Association.

F. G. STEINEBACH, Editor, *The Foundry*, Penton Publishing Co., Cleveland, Ohio, is serving as chief of the foundry equipment and supplies unit of the Tools Section, Aircraft, Ordnance and Tools Branch, Products Division, Office of Production Management.

JORGE ANCIZAR-SORDO, Director, Laboratorio Quimico Nacional de Analisis e Investigacion, Ministerior de la Economia Nacional, Bogota, Colombia, has been elected Vice-President of the Colombian Chemical Society (Sociedad Colombiana de Quimicos) recently organized in Bogota, Colombia.

G. H. DENT is now Assistant District Engineer, The Asphalt Institute, Washington, D. C.

P. A. MILLS, formerly Manager, Pittsburgh Office of Moody Engineering Co., Inc., Pittsburgh, Pa., is now president of the company.

WRIGHT WILSON is now with the Metal Moulding Corp., Detroit, Mich. He was formerly with the Chrysler Corp., Detroit.

E. I. VALYI, who was Consulting Metallurgist, Injecta, Ltd. (Switzerland), in New York, N. Y., is now Metallurgist, The Hydraulic Press Manufacturing Co., New York, N. Y.

H. R. THOMAS is now Research Engineer, David Taylor Model Basin, U. S. Navy, Carderock, Md. He was formerly Special Research Professor of Engineering Materials, University of Illinois, Urbana, Ill.

H. D. WILLIAMSON who was Instructor, Department of Mechanics, Rensselaer Polytechnic Institute, Troy, N. Y., is now Construction Engineer, Raymond Concrete Pile Co., Honolulu, Oahu, Hawaii.

E. G. STERN, formerly Research Assistant in Engineering Research, The Pennsylvania State College, State College, Pa., is now Assistant Professor in Engineering Research, Virginia Polytechnic Institute, Blacksburg, Va.

J. F. VOGDES, JR., who was Engineer, Glen Gery Shale Brick Corp., Reading, Pa., is now Engineer, Day & Zimmerman, Inc., Philadelphia, Pa.

J. C. COONLEY, who was Production Engineer, The Lucas Machine Tool Co., Cleveland, Ohio, now holds a similar position with the Heald Machine Co., Worcester, Mass.

HERBERT SPIGEL, formerly in industrial engineering and architectural practice, is now connected with Sears, Roebuck & Co., Chicago, Ill., as Industrial Engineer.

HERBERT SPENCER, who for many years has been in the Asphalt Division of the Standard Oil Co. (New Jersey), has retired from this position as of May 1, and has assumed the position of President of The Asphalt Institute, the Board of Directors announcing his election on May 1. His office is at the Institute headquarters, 801 Second Ave., New York, N. Y.

G. A. SAEGER, formerly Chemical Engineer, Gulf Portland Cement Co., Houston, Texas, is now General Supervising Chemist, Ideal Cement Co., La Porte, Colo.

D. S. JACOBUS, who was Advisory Engineer, The Babcock & Wilcox Co., New York, N. Y., has retired.

M. S. SCHWARTZ is now Naval Architect, Philadelphia Navy Yard, Philadelphia, Pa.

A. L. ALBSI is Naval Architect, Norfold Navy Yard, Portsmouth, Va.

W. B. WHITE has retired from his position as Superintendent, Bureau of Surveys, New York Board of Fire Underwriters, New York, N. Y.

D. E. Pearsall, who for the past eleven years has been The Ensign Bickford Co.'s Fellow at Mellon Institute of Industrial Research, has been made Director of the recently organized Bickford Research Laboratories, located at Avon, Conn.

MEN IN GOVERNMENT SERVICE AS A RESULT OF NATIONAL DEFENSE WORK

A number of members of the Society have volunteered or have been called into active service in connection with Government work, some on a temporary basis, others "for the duration."

VICTOR HICKS is now Lieutenant, U.S.N.R., Bureau of Ordnance, Navy Department, Washington, D. C.

M. REA PAUL is Consultant to Protective Coatings Section, Division of Purchases, Office of Production Management, Washington, D. C.

L. M. MORRIS is with Headquarters Quartermaster, Replacement Center, Camp Lee, Va.

E. K. SHIRK is with the Army Engineers, Alexandria, Va.

H. G. OLIVER, JR., is Second Lieutenant, Office of the Constructing Quartermaster, Pine Camp, Watertown, N. Y.

H. S. KARCH, is Captain of Ordnance, Cleveland Ordnance District, U. S. Army, Cleveland, Ohio.

M. B. CHITTICK is Office Chief of Chemical Warfare Service, War Department, Washington, D. C.

E. J. HERGENROETHER is with the Conservation Section, Office of Production Management, Washington, D. C.

C. H. STEVENS is Chief Zone Engineer, Construction Division, Quartermaster General's Office, Zone III, War Department, Baltimore, Md.

H. H. WAPLES is serving in the Government Conservation Branch, Office of Production Management, Washington, as an adviser on building materials.

A. R. KEMP is connected with the Government Conservation Branch, Office of Production Management, Washington, as an adviser on non-ferrous metals.

G. R. CONAHEY, JR., is now Lieutenant, CEC V (s), U. S. Naval Reserve, Naval Supply Depot and Dry Dock, Bayonne, N. J.

R. R. Litehiser is now Major, Field Artillery, New York Port of Enbarkation, Brooklyn, N. Y.

NECROLOGY

We announce with regret the death of the following members and representatives:

ROBERT JAMES CALDER, President, International Creosoting and Construction Co., Galveston, Tex. Member since 1914.

W. W. CRAWFORD, President, The Edward Valve and Manufacturing Co., East Chicago, Ind. Member since 1926.

OTIS E. HOVEY, Consulting Engineer; and Director, The Engineering Foundation, New York City. Member since 1908. Mr. Hovey was a special adviser on the Section on Bend Testing of the Subcommittee on Mechanical Testing of Committee E-1 on Methods of Testing until it was discharged in 1940.

WILLIAM A. KITTO, General Manager, The Structural Slate Co., Pen Argyl, Pa. At the time of his death Mr. Kitto represented his company in its membership on Committee C-18 on Natural Building Stones and Subcommittee III on Test Procedures, having formerly been a personal member of the committee.

A. MOULTRIE MUCKENFUSS, Research Chemist, Melrose, Fla. Member since 1909. Mr. Muckenfuss, whose activities were reviewed in the article on long-time Society committee members appearing in the March, 1938, ASTM BULLETIN, had been especially active in the work of Committee D-1 on Paint, Varnish, Lacquer, and Related Products, his membership having been continuous since 1914. His outstanding services concerned the work on anti-fouling paints and on accelerated tests for protective coatings. His extensive 1914 "Report on a Permeability Test for Paints and Varnishes," covering some 94 pages, still ranks as one of the most extensive in the *Proceedings*. This paper has been indicated as the first scientific attempt to study the application of accelerated testing schemes to paint products for exterior service. Mr. Muckenfuss had been connected with a number of industrial companies and had headed and established chemistry departments at a number of southern universities.

W. R. OGLESBY, Chief Chemist and Vice-President, Carney Cement Co., Box 28, Mankato, Minn. At the time of his death Mr. Oglesby was the representative of his company on Committee C-1 on Cement.

A. M. SMOOT, Vice-President and Technical Director, Ledoux & Co., Inc., New York, N. Y. For a number of years Mr. Smoot had represented his company in memberships which it held on several A.S.T.M. technical committees concerned primarily with metals and alloys including Committees A-9 on Ferro-Alloys, B-2 on Non-Ferrous Metals and Alloys, and E-3 on Chemical Analysis of Metals. He served on a number of subcommittees of these standing groups.

Addresses Wanted

Anyone knowing the present address of the following members, whose last-known addresses are given below, is asked to notify the Secretary-Treasurer:

Rossiter M. McCrone, Civil Engineer, U. S. Engineers, Gulf of Mexico Division, War Dept., 412 Masonic Temple, New Orleans, La.

W. A. Moody, Chemist, 8137 Prairie Ave., Chicago, Ill.

James F. Reville, Structural Engineer and Consulting Engineer, 322 E. 149th St., New York, N. Y.

Catalogs and Literature Received

GEORGE SCHERR CO., 128 Lafayette St., New York, N. Y. A four-page folder entitled "GS Tool Chests" describing chests for toolmakers, machinists, craftsmen.

E. H. SARGENT & CO., 155–165 E. Superior St., Chicago, Ill. A 40-page booklet entitled "Polarographic Analysis," a new brochure discussing the American Model XI Heyrovsky Polarograph, its maintenance and operation. Illustrated.

CORNING GLASS WORKS, Corning, N. Y. An extensive catalog, LP 21, 155 pages, entitled "Pyrex Brand Laboratory Glassware Including Fritted Ware and Vycor Brand Laboratory Glassware." This catalog supersedes all previous editions and supplements. The catalog is divided into four parts—I, "Pyrex" Brand Laboratory Ware; II, "Vycor" Brand Laboratory Ware; III, "Pyrex" Brand Fritted Ware; IV, "Pyrex" Brand Pharmaceutical Ware, and is profusely illustrated. The index shows all new items in bold type.

LEEDS & NORTHRUP CO., 4934 Stenton Ave., Philadelphia, Pa. A 28-page catalog, T-623, entitled "Homocarb Method for Carburizing." This catalog shows representative heat-treats, furnaces in action, and various types of work being carburized telling how results are obtained. It includes many photographs, diagrams, charts and photomicrographs demonstrating the Homocarb Method.

THE GAERTNER SCIENTIFIC CORP., 1201 Wrightwood Ave., Chicago, Ill. Bulletin 151-14 describing the Two-Lens Quartz Spectrograph L254. Lists the major new features, gives detailed description of spectrograph, lists accessories and special attachments for the spectrograph. Twelve pages, illustrated.

CENTRAL SCIENTIFIC CO., 1700 Irving Park Road, Chicago, Ill. The latest General Catalog of Laboratory Apparatus and Scientific Instruments J 141, one of the most extensive catalogs of its kind ever issued. A veritable encyclopedia of instruments, apparatus, and supplies for physics, chemistry, the biological sciences and industrial testing. The catalog is arranged in twelve sections as follows: Balances and weights; chemical apparatus; analytical and industrial testing; clinical testing, bacteriology, pathology; projection lanterns, magnifiers, microscopes and microtomes; chemicals; index; physical chemistry and chemical physics; physics; tools and raw materials; blowers and vacuum pumps; constant temperature apparatus and devices.

The index, printed on special tinted stock, is placed in the center of the book, which practice has proved to be a definite convenience, and covering 64 pages enables anyone to find quickly particular items of interest even though there are a great many thousand different items covered in the catalog.

The selection of illustrations is good; the descriptive text is carefully edited and arranged for convenient study. Bound in heavy board covers this 1664-page catalog is an outstanding job. For those who are equipping new laboratories and wish to have a reliable guide for developing a list of equipment for materials, the catalog would be of distinct help. Because of its size, the catalog is distributed to a selected group. Members of the Society who are interested, however, can write on their company stationery to the Central Scientific Co.

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